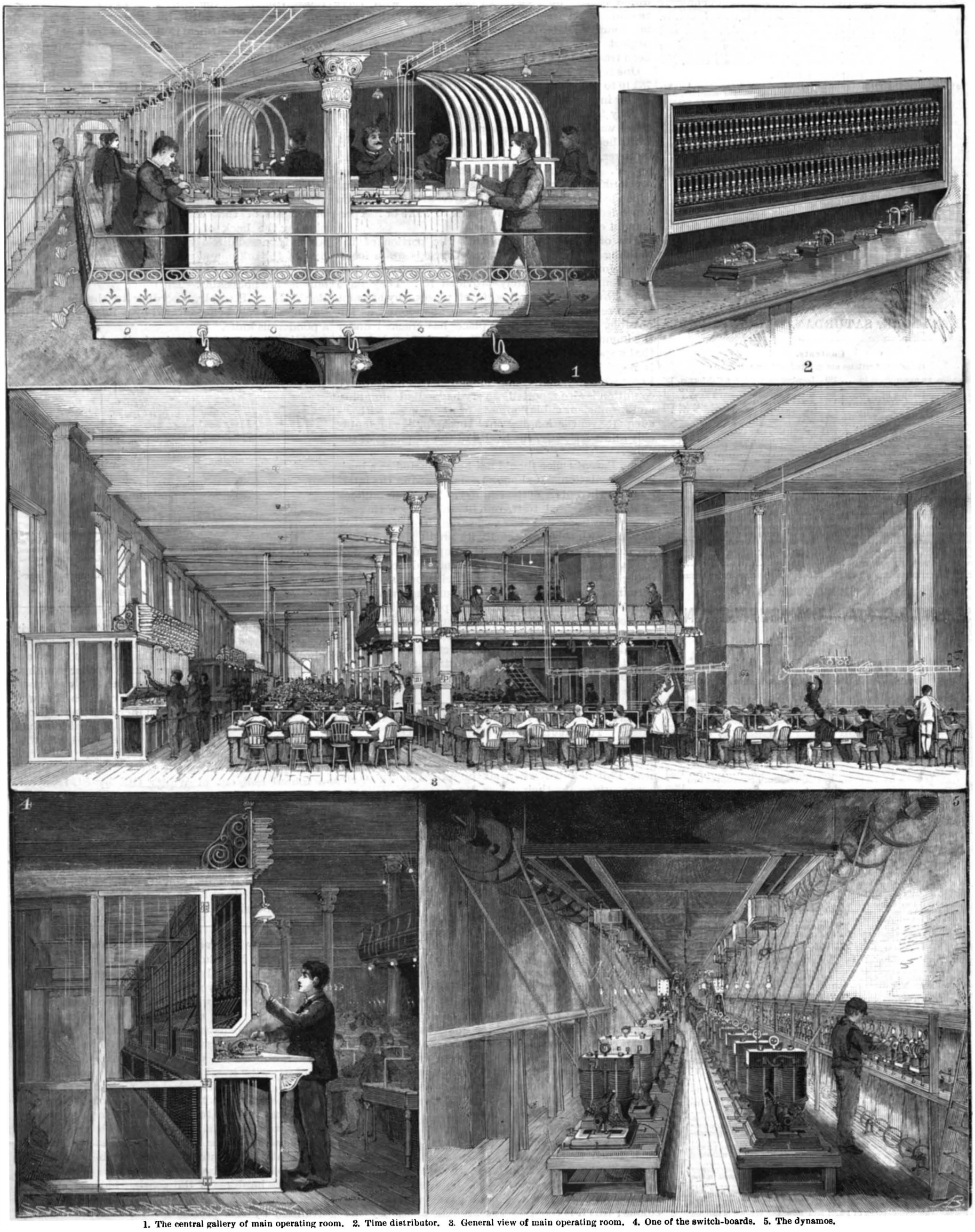
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyrighted, 1892, by Munn & Co.

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

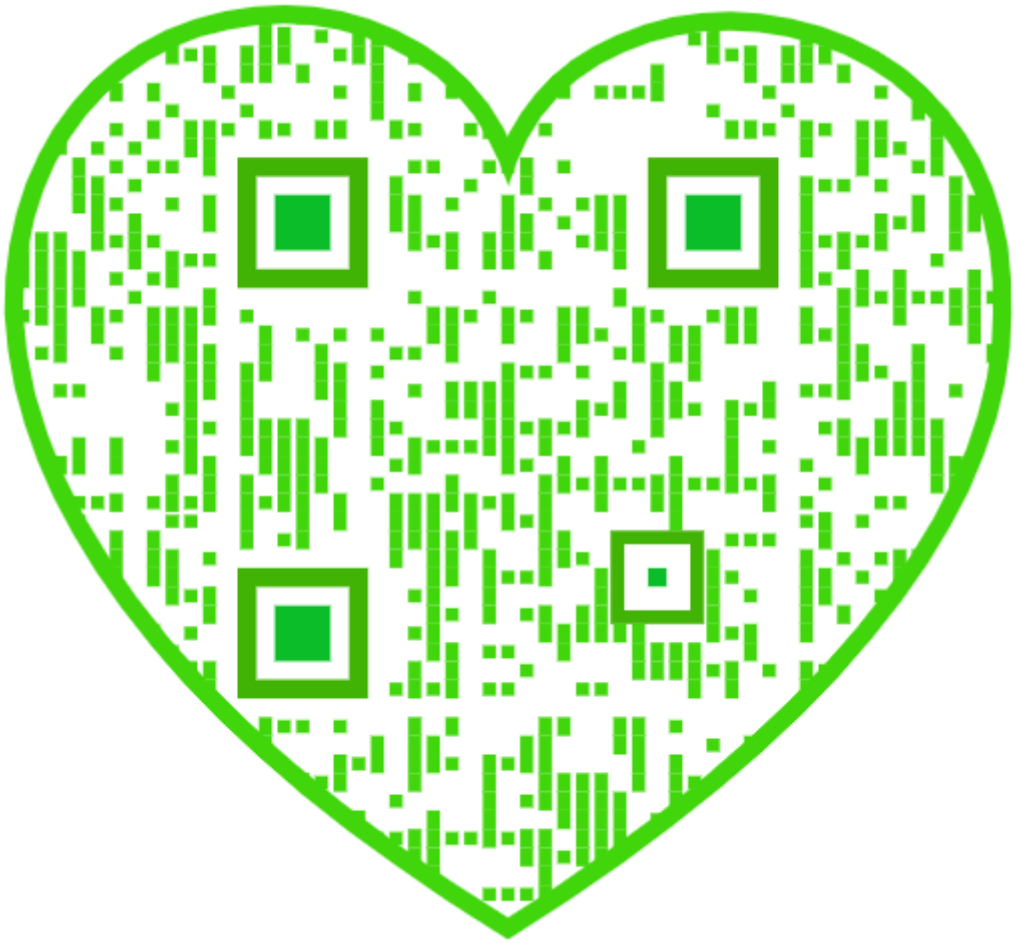
Vol. LXVI.—No. 13. ESTABLISHED 1845. NEW YORK, MARCH 26, 1892. $3.00 A YEAR. WEEKLY.



1. The central gallery of main operating room. 2. Time distributor. 3. General view of main operating room. 4. One of the switch-boards. 5. The dynamos.

THE WESTERN UNION CENTRAL TELEGRAPH OFFICE AND PLANT IN NEW YORK CITY.—[See page 198.]

© 1892 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct pape from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *nine dollars a year*.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, $5.00 a year; combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign countries, $11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, MARCH 26, 1892.

Contents.

(Illustrated articles are marked with an asterisk.)

Acoustics, an experiment in..... 199
Agricultural inventions, recent.. 201
Atoms, the clashing of..... 194
Alternator, rapid, Tesla's*..... 195
Bell, Alexander Graham*..... 199
Books and publications, new..... 203
Carpenter's square..... 200
Cart, dump, Smith's*..... 194
Cattle, tubercular disease in..... 192
Congress and the Patent Office.. 192
Creede, mining town, Colorado.. 196
Dynamo connections, Western Union*..... 198
Edison, Thomas A.*..... 199
Electrical discoveries of Joseph Henry..... 193
Electrical storage battery car, new..... 200
Electricians distinguished*..... 199
Engine rotary, Lycan's*..... 194
Experiments, Tesla's*..... 195
Fence machine, Mason's*..... 197
Furnace, Hughes'*..... 197
Horses eating dirt..... 194
Ice plow, Pray's*..... 194
Inventions, recently patented... 201
Lumber enterprise, a California. 193
Lymph tests, recent..... 192
Mining appliances, some new.... 201
Notes and queries..... 201
Orange trees, infected..... 194
Patent Office, the, and Congress 192
Patents granted, weekly record.. 203
Petroleum, new theory of origin of..... 200
Photographic blue transparencies..... 194
Prize medal offered for invention..... 193
Quicksilver production, New Almaden..... 200
Register, water, Carpenter's*.... 195
Telegraph plant, Western Union, N. Y.*..... 191
Tesla, Nikola*..... 199
Thomson, Prof. Elihu*..... 199
Ventilation, stokehold..... 199
Warship Ramillies, British..... 193
World's Fair, Chicago, bird's eye view of*..... 200
World's Fair dedication ceremonies..... 192

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 847.

For the Week Ending March 26, 1892.

Price 10 cents. For sale by all newsdealers.

PAGE

I. BIOLOGY.—Deep Sea Dredging.—Results attained by the United States Fish Commission steamer Albatross in the Pacific Ocean 13536
What is an Ant?—By E. A. BUTLER.—The distinguishing features of ants and notes on other insects resembling them.—3 illustrations 13537
II. CHEMISTRY.—A Mydriatic Alkaloid in Lettuce.—By T. S. DYMOND.—Approximate constituent of lettuce.—An interesting chemical examination 13541
Apparatus for Measuring Liquids Quickly.—by ALEX. F. REID.—Easily constructed apparatus for the above purpose for laboratory use.—1 illustration 13542
Gum Arabic and Gum Senegal.—Chemical distinction of the two gums 13540
Some Experiments on Petroleum Solidification.—By SAMUEL RIDEAL.—Some interesting experiments on the subject with various materials 13540
The Preparation of Quinine.—The manufacture of quinine and allied alkalies 13540
III. CIVIL ENGINEERING.—The Conduit for the Water of the Avre.—Pipe-laying operations near Paris, with full views of the operations in progress.—1 illustration 13527
IV. ELECTRICITY.—An Electro-Plating Plant.—An extensive plating factory depositing an alloy to take the place of silver.—3 illustrations 13531
Electricity in a Modern Residence.—By H. WARD LEONARD.—What may be done with electricity in the dwelling 13531
Improved Electric Heat Alarm.—A device for giving an alarm when a journal gets overheated.—2 illustrations 13532
Note on the Conductivity of Peroxide of Lead.—By JOHN SHIELDS.—An important research, with special reference to storage batteries.—1 illustration 13532
The Electric Process for Manufacturing Chlorine and Caustic Soda.—A process under trial in London using Greenwood's electrolyzer.—5 illustrations 13532
Nikola Tesla.—Notes on the work in high frequency electric currents by the great experimenter 13533
V. FISH CULTURE.—Artificial Oyster Culture in France.—A graphic description of the culture of this mollusk 13536
Oyster Culture at Arcachon, France.—Another article on the subject of oyster culture with characteristic illustrations.—15 illustrations 13534
VI. MECHANICAL ENGINEERING.—Improved Spring Forging Machine.—A machine for forging carriage springs at a single heat.—1 illustration 13529
Novel Friction Gearing.—Method of varying the relative speed of rotation of two shafts.—1 illustration 13529
The Bursting Pressure of Cylindrical Boilers.—Deduction of rules for ascertaining the above data.—4 illustrations 13528
VII. METALLURGY.—Open Hearth Steel Castings.—By J. A. HERRICK.—The production of direct steel castings and the advantages of open hearth steel for this purpose 13533
VIII. MISCELLANEOUS.—Proscenium Curtains.—A recently invented fireproof theater curtain 13542
IX. NAVAL ENGINEERING.—A Shoal Water Signal.—A species of water kite which indicates automatically shoal water 13529
The New Greek Turret Ship Spetzia.—The ship claimed to be the most powerful war ship of its tonnage afloat.—1 illustration 13529
X. OPTICAL PROJECTION.—Optical Projection of Opaque Objects.—By GEORGE M. HOPKINS.—Improved construction of the megascope, the megascope attachment to lanterns and a simple megascopic camera.—7 illustrations 13538
XI. PHOTOGRAPHY.—Celluloid Films.—By J. DESIRE ENGLAND.—The manufacture, coating of and notes on the use of celluloid films in photography 13530
XII. RAILROAD ENGINEERING.—Distance Run in Emergency Stops at Various Speeds.—Tabulation of results attained in the air brake trials of recent years 13528
Chinese Railroads.—An American engineer in China and his circulars to the employes on starting the railroad 13528
XIII. SANITARY ENGINEERING.—The Sanitary Institutions of Paris. The ambulances of Paris and how the service is carried out.—3 illustrations 13539
XIV. TECHNOLOGY.—The National Milling Company's New Plant at Toledo, Ohio.—Description of this great mill and its dimensions and arrangements.—1 illustration 13530

CONGRESSIONAL INQUIRIES CONCERNING THE PATENT OFFICE.

We have had occasion to speak of the crowded condition of the Patent Office, and the resulting delays in reaching results in the prosecution of work. The matter has assumed serious proportions, and it is no longer delay in carrying on the regular operations that is to be apprehended, but a suspension of important parts of work seems imminent.

The subject has been brought to the attention of Congress, and two Senate resolutions have been passed, one asking for an account of all money received by the Patent Office and of the disposition made of it; the other inquiring as to the safety and sanitary condition of the building. In compliance with these resolutions reports have been rendered by the Commissioner of Patents which cast a strong light on the neglect with which the interests of inventors have been treated in this country.

One report shows that there is a balance of $4,041,753.10 to the credit of the Patent Office. This balance is now in the Federal treasury. By Act of Congress of July 28, 1868, the money received from the Patent Office was no longer kept separate. but was included with the other amounts from all sources. The office, however, has kept an account of all such money transmitted. Of this money $358,000 has been appropriated for building purposes, although only a portion was expended. In addition a little over $250,000 has been expended upon the office for work of more or less permanent character.

The other report shows that the portion of the building allotted to the Patent Office is quite insufficient for its purposes. The storage of printed copies of patents is inadequately provided for. They have to be stowed away in all sorts of places, any attempt at consecutive order having been abandoned as impossible. The brickwork in places has cracked under the immense weight of the printed copies. It is said that a special training in the geography of the place is requisite to enable a new clerk or messenger to know where to find copies of patents. The sanitary condition is also reported as very bad. Bad plumbing and insufficient cubic contents of the rooms, with inadequate ventilation, not only threaten, but undoubtedly affect seriously, the health of the employes of the office.

The Patent Office should not be conducted as a business speculation. It should be managed in the interest of the inventors of the country. The four millions of dollars credited to it, or a liberal portion thereof, should be expended on perfecting its service. At present, with this amount to its credit in the U. S. Treasury, the Patent Office is hampered for want of funds, its corps of examiners are rendered incapable of doing justice to themselves or to their work, simply on account of their unfavorable surroundings, and what is to be done in the near future to provide storage for printed copies of patents is altogether problematical.

The Hon. Commissioner of Patents is to be congratulated on having brought this subject before Congress, and it is to be hoped that his efforts in the service of the country's inventors will be well seconded by legislative action.

RECENT LYMPH TESTS AND EXAMINATIONS FOR TUBERCULAR DISEASE IN CATTLE.

An expensive but scientifically valuable series of experiments was made on March 16 at Clairemont Farms, near Philadelphia, when six high-bred Jersey cows were sacrificed by their owner, Mr. Joseph E. Gillingham, in the interest of sanitary science. Out of a large herd of valuable Jerseys, all of known and registered lineage, a herd that is famous among American cattle breeders, over a score had been selected for slaughter on account of the presence in them of tubercular disease. The presence of this dread malady was made known by the use of Koch's lymph used in the way now familiar to all. Out of seventy-nine head of cattle, thirty had responded to the treatment in such a way as to convince Professor Leonard Pearson, of the Veterinary Department of the University of Pennsylvania, that tubercular taint was present.

The killing of these very valuable animals was a voluntary sacrifice on the part of Mr. Gillingham, for while the State and local sanitary officers and inspectors were present by his invitation, no action had been taken that made the slaughter obligatory upon him. It was entirely in the interests of the continued health of the rest of his herd that they were now sacrificed, and in the interest of a better acquaintance with this disease that over a hundred prominent scientific men and others likely to be interested in these researches were specially invited to be present.

In this herd the purity of the stock has been maintained by the use of all the leading Jersey strains. Such blood as comes from Coomasie, Stoke-Pogis, Rioter, Guilderoy and St. Lambert sires is here, yet, notwithstanding the greatest care having been taken, in some way many of the herd have become tuberculous; this it is thought was brought about by the recent introduction into the herd of some imported cows. Be this as it may, when not long since several of them became sick they were killed, and an examination showed them to have been suffering with tubercular disease. Mr. Gillingham at once decided that all the herd should be carefully examined by Professor Pearson, with the results above stated.

Having discovered so large a proportion of diseased cattle, 38 per cent of the entire herd, and reasoning that what could so soon come to pass under the most careful management was likely to spring up elsewhere under like conditions, the occasion was made by him one of public education. Professor Pearson and Drs. Shakespeare, Guiteras and Abbott were selected as a committee to examine the animals slaughtered and report to the assemblage. Among the latter were representatives of the State Board of Agriculture, the State Board of Health, the University of Pennsylvania, Jefferson Medical College, the National Bureau of Animal Industry and many prominent medical men from Philadelphia and elsewhere.

Owing to the time taken in making examinations that were entirely satisfactory to the experts present, only six of the doomed animals were killed; the rest will be killed later in a more private manner, when only those most intimately connected with the cause of sanitary science will be present. The killing of five of these was done by Dr. S. J. Harger, professor of anatomy in the University of Pennsylvania, by a method technically known as "pithing." This is virtually the usual death stroke dealt by Spanish toreadors in the bull fights of that country. It consists of quickly piercing the back of the neck with a stout dagger, which is passed directly through the spinal cord at the base of the brain, and results in death so instantaneously that only the natural reflex actions of the muscles are noticeable. The other cow was killed by Rabbi Isaac Stemple, according to the Hebrew rite, the jugular vein being severed by a mighty blow from a ponderous knife.

Of the six slaughtered animals, the following statistics were gleaned from the experts and the head herdsman:

Name.	Age.	Strain.	Effect of the injection of the lymph.		Location of tubercles.
			Temperature before.	Temperature after.	
Juno.....	4 yrs.	Glucaire	102	106½	Slight in intestines.
Lena.....	4 "	Clairmont	102¾	106¾	Lymphatic glands.
Steena ...	2 "	Clairemont	101¾	106¾	" "
Sylvia....	4 "	"	.....	.....	Large on the lungs.
Phyllis...	3 "	....	102½	107	" " "
Pity.. ...	3 "	....	101½	106	" " "

After the autopsies Dr. Guiteras announced that in five of the cows there were indisputable evidences of tubercular derangement, and that as some doubt appeared to exist as to the other (Juno) a fuller examination would be made by the committee. It was generally conceded, however, in after conversation that well formed tubercles were found on her intestines. None of the doomed cows or calves are valued at less than $150, and among them Rose, valued at $1,000, who gives 43 pounds of milk daily, is yet to die.

In a spacious stall near by was Amber Stoke-Pogis, an inbred bull, out of Waiter Girl by St. Lambert. This noble animal, though only six years old, weighs 1,700 lb.; his sire has twenty-seven daughters on the tested list, and is now practically the greatest of his breed now living. Beyond this stall was that of Signal, sired by Amber Stoke-Pogis out of Rose; though a beautiful little fellow outwardly, showing every sign of health and coming great value, he too is doomed, for the lymph has shown that from his dam he has inherited the tubercular taint.

Low Temperature Galvanizing.

The London Metallurgical Company are introducing a new process of galvanizing, which seems to have several advantages over the older process. The process appears to be one in which zinc is deposited from its solution in the cold on the wire or sheeting to be coated, and the inventors claim that in this way a more even and uniform thin coating of the protective metal is obtainable, while at the same time, in the case of wire, the tensile strength is not diminished, as occurs when thin iron or steel wires are galvanized by the common methods of steeping in molten zinc. At the ordinary temperature, too, there is no appreciable tendency to form a zinc-iron alloy, which causes a considerable waste of zinc in addition to the reduction of strength already pointed out, and may be regarded as a further defect in the present system. Comparative tests on the hardness of the coating on iron sheeting by means of the sclerometer also show that a plate galvanized by this process has a harder surface than that obtained by the ordinary hot method of galvanizing.

© 1892 SCIENTIFIC AMERICAN, INC.

The Electrical Discoveries of Joseph Henry.

A highly interesting and instructive series of articles upon the electrical discoveries of the late Joseph Henry, of Washington, by his daughter Mary A. Henry, has lately been presented in the *Electrical Engineer*, of this city. Illustrations were given of the original apparatus employed by the distinguished philosopher, many parts of which are still extant, together with copious abstracts from his notes and scientific essays. That Joseph Henry was the maker of the first electro-motor, the maker of the first magneto-electric telegraph, and the discoverer of magneto-electricity is established in these papers by the clearest historical evidence.

The concluding article of the series we have alluded to closes as follows:

A brilliant spark flashes in young Henry's studio in 1829, to betray to him, in the extra current, the secret principle of the dynamo. To-day, this potent instrument enters factory and home in a thousand ways the effectual slave of man, while tired horses rest in their stables as it drives our cars to and fro. High up in our city street, when night comes down, the electric spark, leaping from wire to wire, burns a carbon point and turns our darkness into day. The lightning, forced to be man's messenger in the telegraph, compelled to do his work in the electric motor, has been caught in its free play from cloud to cloud to do this service; even as the steed once coursing in wild freedom over the plain now threads with patient feet the medley of rolling wheels on the pavement below. To tame the intermittent flash into this steady, cheering ray, Henry developed the magnetic force, and Faraday and Henry both set electricity and magnetism to work, the one producing the other; but that they can do so anywhere is due to the discovery of Henry, which made it possible to call them into conjunctive action *through any length of wire.* Each year, each month, each day almost, adds some new blessing to the world, through the great discovery of the *identity of electricity and magnetism.* Let England sing her hymn to Faraday; he well deserves it; but let not America forget the meed of praise due her Henry. His is surely not the second place in the great discovery.

THE SEQUENCE

of Discoveries Connected with and Accompanying the Discovery of Magneto-Electricity.

1829	The making of the powerful intensity magnet, capable of excitation at a distance; the magnet of the telegraph of to-day. The making of the quantity magnet. The discovery of the law embodied in Ohm's theory of the relation between the electric flow and electric resistance. The discovery of the combination rendering possible the telegraph. The making of the first magneto-electric telegraph. *The discovery of and sparks obtained from the extra current*, now considered the same phenomenon as that of magneto-electricity.	BY HENRY.
1830	The perfection of the quantity magnet, the stepping stone for both Faraday and Henry in the discovery of magneto-electricity. *The discovery of magneto-electricity.*	BY HENRY.
Aug. 1831	The making of the first electric motor. Experiments on a large scale with magneto-electricity; the making of a dynamo.	BY HENRY.
Aug. 29-30, 1831	Experiment with Henry's magnet in the form of a ring, in which the phenomenon of magneto-electricity was obtained, but not fully recognized.	BY FARADAY.
Sept. 24, 1831	Experiment with a bar magnet, viz.: *The discovery of magneto-electricity.*	BY FARADAY.
Oct. 17, 1831	Experiment of inserting cylindrical bar into the end of a helix cylinder, usually given in text books as the one by which the discovery of magneto-electricity was made.	BY FARADAY.

A California Lumber Enterprise.

The most important timber land deal carried out in California is the recent securing of 28,000 acres of pine timber land in Siskiyou and Shasta counties by Miles & Brewster, of Green Bay, Wis., and Tatum & Bowen, of San Francisco.

The land lies in sections, scattered over a virgin district which is the largest pine timber belt in the State. It is in southeastern Siskiyou and northeastern Shasta. The region comprises nearly 500,000 acres of timber. It is all east of the California and Oregon Railroad, and also east of the Squaw Mountain range. Most of the land lies on a comparatively level plateau.

Miles & Brewster and Tatum & Bowen have been quietly at work for three years gaining possession of timber land in this region, by buying it from original claimants, who gained possession under the usual government rules. They found nearly all the land not owned by the railroad there to be in the possession of these small claimants, each of whom had secured 160 acres. It was found necessary to use the greatest secrecy in making these purchases, for had the object of them become known, the claimants would have advanced their prices. As it was, the land was bought at an average price of $15 an acre, and it was gradually absorbed, until 6,000 acres had come into possession of the capitalists.

After making these extensive purchases they began negotiations with the Southern Pacific Company, bonding 11,000 acres, which they have now virtually purchased, and have begun negotiations for the purchase of some 12,000 acres more. As all the land has been or is to be bought at an average rate of $15 an acre, the total 23,000 acres purchased from the railroad company will cost the lumber company $345,000, which, added to the $90,000 already expended for the lands of private individuals, will make a total of $435,000.

A standard gauge railroad, forty miles long, will be built at once; will cost some $800,000. The road will start from lower Soda Springs, in Shasta County, on the California and Oregon, and will follow Soda Creek, passing over the Squaw Mountain range, and running by Bigelow's and Bartle's northeasterly up into Siskiyou County. For the first five miles the line will be rather difficult of construction, but after the Squaw Mountains are passed it will be almost level, and very easy to build. The timber belt will be reached within ten miles, but although cutting and sawing will be begun somewhere within that distance, the road will be extended through the timber, in order that sawmills may be located far enough apart to insure a long period of usefulness for them before removal.

The importance of this new lumber industry to San Francisco can hardly be estimated. All of the pine timber lands of the northern part of the State, beyond Mount Shasta, to reach this city by rail, must be hauled up very heavy railroad grades before they can be brought down through the Sacramento Valley. The new enterprise, however, is one which involves a much less mileage for freights, and there is a down grade from the timber belt to San Francisco nearly all the way.—*Pacific Lumberman.*

Launch of the Great British Warship Ramillies, the Largest and Most Powerful Ship Afloat.

At a time when so much is being written on the subject of the relationship of the government to private manufacturers, and of the necessity of these latter being encouraged to perfect their means of producing munitions of war, the floating, on March 1, from the yard on the Clyde of Messrs. J. & G. Thomson, limited, of H.M.S. Ramillies, the largest battle ship yet launched from a private establishment in the United Kingdom, and, indeed, in the world, and costing 843,000*l.* ($4,215,000), is, says *Engineering*, worthy of more than a passing reference. The contention for a closer bond between the army and navy departments and the private establishments in the kingdom is based on the necessity of the government having at their disposal the most extensive resources possible at a time when war is imminent or even probable, and although that would scarcely be a time to lay down battle ships, it is desirable to have yards equipped for the building of battle ships, on the principle that a works capable of keeping pace with the royal dockyards in the building of large vessels may do similarly well with small craft. Besides, the building of ships of war requires quite an education on the part of the workmen as well as of superintendents. In the building of a cargo steamer or "tramp" "the rule of thumb" is a useful factor; but when a warship is in course of construction drawings must be made almost for every detail. In the case of the Ramillies there have been 5,000 plans in use, and they were constantly in requisition. The men in the Clydebank yard of the Messrs. Thomson, limited, are now quite used to such important work. Indeed, for several years past they have seldom been without a warship or 20 knot steamer, and in the past two years they have had something like a million and a third sterling of work from the Admiralty. Besides, the Messrs. Thomson have designed and built several remarkably successful craft for foreign countries, including Spain, Russia, and Japan.

The Admiralty had, therefore, confidence in placing an order for a battle ship of over 14,000 tons with the firm in November, 1889, and the work has been quickly done.

The keel of the Ramillies was laid in August, 1890, so that she has only taken 19 months to build, and when we remember that great credit was and is still taken for the building of the sister ship Royal Sovereign in the Portsmouth Royal Yard, with all its resources, in 17 months, and that the Devonport yard took 22 months to the Empress of India, and the Pembroke yard 34 months to build the Repulse, launched on February 27, Messrs. Thomson have to be congratulated on their performance. In the initial stages 40 tons of steel were built into the ship each day, and now there are a million and three-quarter rivets holding the structure together. These weigh 300 tons. The plates, previous to their being taken in hand for working, had to stand for a few hours in a liquid consisting of nineteen parts of water and one part of hydrochloric acid. When the plates were removed from the dilute acid both the surfaces were well brushed by brushes worked by machinery, and washed to remove any scale which might still adhere to them. They were then thoroughly washed with fresh water by the aid of a hose, then placed on edge to dry. This process removed all the black oxide or scale which adheres to the plates and has the effect of corroding them when placed in communication with sea water. The ship was ready for the armor plating in August, but the plates were not forthcoming. Owing to the simultaneous building of eight battle ships under the Naval Defense Act, steel manufacturers had their resources severely taxed. Otherwise the Ramillies would have been launched some time ago. The armor extends for two hundred and fifty feet along each broadside of the ship, and at each end the two sides are connected by a transverse armor belt. The belt is 18 inches thick, and required special machinery to work it. The drilling of the holes, 5½ inches in diameter, for the bolts, was done by electric power, with specially devised machinery, the perforation of the hole in the plate and in the teak backing being one operation. So complete were the arrangements that 3½ days served for the preparing and fixing of each armor plate weighing 30 tons. The plates are of compound steel, the outer face being of hard steel, while the inside portion is much softer and more ductile, and prevents the cracking of the hard steel face by the impact of shot. As it is important to avoid making any holes in the hard steel face, the plates are secured by bolts 5½ inches in diameter, having a screw thread in each end. A hole is made in the softer steel in the inside of the armor plate, and when the plate is put on to the ship's side the bolt is passed through from the inside of the ship and is screwed into the hole made in the inner part of the armor plate. A long washer is passed over the inside end of the bolt, and rests upon the inside of the skin of the ship, and inside of all a large nut is "hove up" on the end of the bolt, which completes the security of the plate.

The 1 inch steel skin of the ship above the armor belt is covered with 4 inch steel armor, which protects the quick-firing gun deck. The 67 ton guns are mounted en barbette, two forward and two aft. The armor in each barbette weighs 643 tons without the backing. The barbette was chosen in preference to the turret because it raised the guns higher and admitted of increased freeboard—it is 18 feet against 10 feet 3 inches in the Admirals. This, in the interests of the men, is a much needed improvement. The tops of the barbettes project 2 feet 9 inches above the upper deck. The axes of the 67 ton guns are only 4 feet 6 inches above the deck.

There are seventy-eight separate engines in the ship. The main propelling engines consist of two sets of engines of the triple compound type. They are in separate compartments with the powder magazine between, so that it will be very difficult for a shot to pass through to the explosives, as, in addition to the armor, it will require to penetrate through coal bunkers and the engine compartment with its many obstructions. It is not necessary now to enter into details as to the engines, as we hope at a later date to illustrate them. Steel and naval brass have been largely used to reduce the weight, and it is expected that the maximum power of 13,000 indicated horse power will be got with a creditably small ratio of weight. Almost everything in the ship is done by machinery, and the engines incidental to the propelling machinery are all independent. Everything, too, is in duplicate, so that should an engine get out of order another engine is available. The steam is supplied by eight single-ended return tube boilers, each with four furnaces 3 feet 6 inches in diameter. For the purpose of shutting off each combustion chamber from the others, and also for regulating the draught, separate dampers are fitted in the passage from each furnace through the smokebox, and gearing is arranged to work these dampers from the stokehold floor. Each pair of boilers is in a separate water-tight compartment, with independent coal supply. For some time both sets of main engines have been completely fitted up to the smallest detail in Messrs. Thomson's works, with the condensers and all connections and shafts in position complete. In the boiler shop, too, the eight boilers are also all arranged in position with smoke boxes, uptakes, and all boiler mountings, furnace fittings, and firebars, and the two funnels each 8 feet 6 inches external diameter and 90 feet high from the furnace level, lying ready for putting on board, so that when the ship gets under the 120 ton sheerlegs at the company's docks, these will quickly be put on board, and the vessel will doubtless soon attain her guaranteed speed of 17½ knots.

Medal Offered for a Printing Device or Process.

At the recent annual meeting of the American Newspaper Publishers' Association, it was "*Resolved*, That the Executive Committee be authorized to have prepared a suitable gold medal, containing not less than fifty dollars' worth of pure metal, to be presented to the inventor or discoverer of any specific device or process, the practical use of which will materially cheapen the production or quicken the printing of newspapers, provided such device or process is in their opinion of sufficient importance and value to be entitled to such recognition."

Sleigh Bells.

In making the bell the jinglet of iron is placed inside a little ball of mud, just the shape of the inside of the bell. Then a mould is made of the outside of the bell. This mud ball is placed in the mould and the metal poured in. The hot metal dries the dirt so it can be shaken out after casting, leaving the jinglet within.

© 1892 SCIENTIFIC AMERICAN, INC.

The Clashing of Atoms.

Professor John Tyndall, one of the highest authorities on matters of natural philosophy, says of this: "It is to the clashing together of the oxygen of the air and the constituents of our gas and candles that the light and heat of our flames are due. When steel filings are scattered in this Bunsen's flame, you see the star-like scintillations produced by the combustion of the steel. Here the steel is first heated till the attraction between it and the oxygen of the air becomes sufficiently strong to cause them to combine, and these rocket-like flashes are the result of their collision. It is the impact of atoms of oxygen against atoms of sulphur which produces the heat and flame observed when sulphur is burned in oxygen or in the air; to the collision of the same atoms against phosphorus are due the intense heat and dazzling light which result from the combustion of phosphorus in oxygen gas. It is the collision of chlorine and antimony which produces the light and heat observed when these bodies are mixed together; and it is the clashing of sulphur and copper which produces incandescence when these substances are heated together in a Florence flask. In short, all cases of combustion are to be ascribed to the collision of atoms which have been urged together by their mutual attractions."

AN IMPROVED ICE PLOW.

The ice plow shown in the illustration is very simple and durable in construction, and designed to be very effective in operation. It has been patented by Mr. Hamilton Pray, of Clove, N. Y. Its frame consists of two parallel longitudinal beams, connected by suitable transverse beams, two U shaped runners of different length being held adjustably on the front and rear ends of each longitudinal beam, while cutting blades of different length are held adjustably on the beams between the runners, extending below the lower ends of the front runners. In beginning to cut an ice field, a first cut is made to serve as a guide for the runners and cutters of the second longitudinal beam, and thereafter the plow is made to travel in grooves already formed, the advance to a new cut being made with the runners and cutters of one beam in a groove already formed, so that the animal is prevented from dragging the plow out of its grooves by a sidewise pull. All the runners and blades are adjustable, so that the plow may be arranged to cut at regular depths at all times, and can be drawn over the ice field with a steady, uniform pull. This plow has been in practical use for two seasons and is said to have given great satisfaction as a thoroughly efficient ice cutter.

PRAY'S ICE PLOW.

No Scale Wanted in California.

On March 1, in Los Angeles, Judge McKinley decided that 325,000 orange trees, which were imported from Tahiti infected with eight different kinds of pests, were to be destroyed. Insecticides were used which destroyed seven of the pests, but the eighth was not killed; hence the decision.

This scale is called the *Chinaspis biclavis*, a pest hitherto unknown in California, a scale that all efforts to eradicate were unavailing.

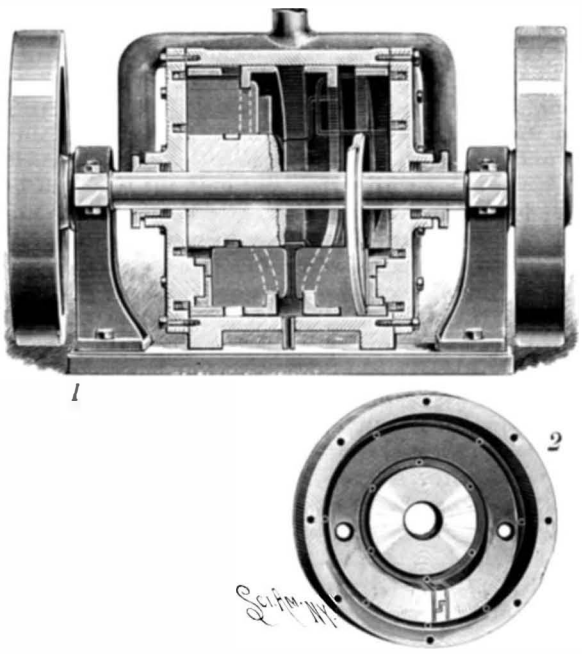
The decision was of very great interest to all fruit growers in the State, as it is the first of its kind ever rendered. It is of interest to Eastern nurserymen also, as they are at the present time trying to get admitted into the State several car loads of infected fruit trees.

R. E. S.

THE U. S. Treasury Department has decided that machinery imported to the Exposition from foreign countries, either wholly as an exhibit or to be shown in connection with the illustration of some manufacturing process, shall be admitted free of duty. Any raw material imported for use in such process must pay regular duty, however.

AN IMPROVED ROTARY ENGINE.

The engine shown in the accompanying illustration is designed to be very effective in operation, utilizing the steam to the greatest advantage, while it is adapted to be run at a high rate of speed. It is constructed of but few parts, so that it is not liable to get out of order, and friction is reduced to a minimum. The invention has been patented by Mr. William S. Lycan, of Marshall, Ill. Fig. 1 represents a longitudinal section of the engine, and Fig. 2 is an inner face view of one of the cylinder heads. The heads are each provided with a double wedge-shaped abutment extending inwardly into the cylinder, while a piston mounted to turn in the cylinder has flanged wheels forming a steam space at the heads, the piston also having slotted projections, gates sliding longitudinally in the webs of the flanged wheels and slotted projections. The steam inlet pipes lead into the steam space near the ends of the abutments, and exhaust pipes lead from this space oppositely, close to the other ends of the abutments. The driving shaft passes centrally through the cylinder heads and cylinder, the hub of the piston being secured on the shaft, while fixed annular cams have their peripheries fitting the inner face of the cylinder between the wheels of the piston, the inner edges of the cams engaging notches in the gates or valves. In a practical trial this engine is said to have developed great power and shown a very high rate of speed.



LYCAN'S ROTARY ENGINE.

Strychnia in Snake Bite.

Dr. Wolfgang Hunt, of the Toowoomba Hospital, Queensland, gives an interesting account in the *Australasia Medical Gazette* of a case which had come under his care. The patient was a child aged sixteen months. An elder sister, while playing with her a little way from home, heard her scream, and saw a snake clinging to her hand. Running to the house she quickly fetched her mother and an uncle, who found the child crying and holding the third finger of the left hand, on which was a small punctured wound. The snake was killed as it was making off, and found to be a "death adder." The child was taken to the house, and the end of the finger removed, the stump being sucked and drenched with ammonia and ligatures applied to the arm. She was then brought to Toowoomba for the nearest medical aid, ammonia being applied to the hand meantime. An attempt was made to give stimulants by the mouth, but vomiting immediately followed their administration. On admission to the hospital, three hours after the accident, the child was almost comatose, the body and the extremities cold, pupils dilated and insensitive to light, the pulse rapid and irregular. The child was at once wrapped in hot flannels and heat applied to the limbs, while four minims of liquor strychniæ were administered hypodermically, and a strong faradaic current applied to the nape of the neck and along the spine. Fifteen minutes later another four minims of liquor strychniæ were injected, and almost at once a change began to manifest itself in all the symptoms, and in a short time the child recognized and played with its parents. With the exception of a few slight muscular twitchings, recovery was uninterrupted, and the child was discharged the next day in apparently perfect health and none the worse, except for the loss of her finger. The case is very important, especially with reference to the means used for procuring recovery, viz., the hypodermic injection of strychnia, and Dr. Hunt is to be congratulated on his success in this case, as well as in that of another patient whom he mentions as having been admitted in a similar condition after being bitten by a brown snake, and in whom also recovery followed the hypodermic injection of strychnia.—*The Lancet.*

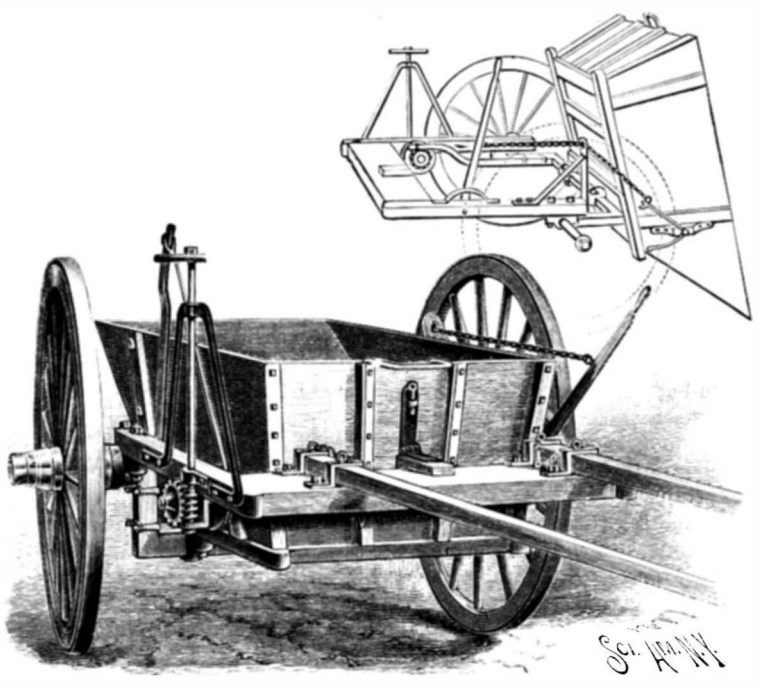
A Fortunate Use of the Microphone.

Prof. D. E. Hughes, F.R.S., writes to the *Electrical Engineer*, London: "Having been engaged for many years experimenting with my microphone for the detection of sounds too feeble for the unaided human ear, I am pleased to notice by the following paragraph in the *Daily Telegraph* of February 25 that it has been successfully applied in St. Petersburg to the saving of human life."

The paragraph says: "Some particulars of a remarkable case of revival from apparent death have come to hand from St. Petersburg. A lady who had been suffering from a violent nervous attack sank into a state of syncope, and after a time ceased, as it seemed, to breathe. The doctor who was attending her certified that death had resulted from paralysis of the heart. For some reason, which is not explained, another medical man, Dr. Loukhmanow, saw the body, and having been informed that the lady had suffered from attacks of hysteria and catalepsy, thought it worth while to make a thorough examination. After trying various other means he applied the microphone to the region of the heart, and was enabled by this instrument to hear a faint beating, which proved that life was not extinct. Everything was done to resuscitate the patient, who, shortly afteward, recovered consciousness."

AN IMPROVED DUMP CART.

The illustration represents a cart which is low and easily filled, and at the same time may be easily dumped. The first point is attained by using a crank axle, which brings the bottom of the body to within 6 or 8 inches from the ground. The body is pivoted upon the axle, and when the latter is in the usual position a comparatively slight tipping brings the rear of the cart in contact with the ground. At this point, when a portion of the load has been discharged, the crank of the axle is made to revolve backward and upward, thus lifting and tipping the body more and more until all of the load is dumped. In this movement the axle turns in the hubs, the arms acting as pivots. This is effected by means of a windlass operated by a worm gear and connected by means of a wire rope to a lever projecting upward from the axle. Sometimes, as in dumping over the string piece of a wharf, it may be desirable to raise the body somewhat before dumping. In this case it is kept steady during the lifting by means of a bar having a parallel action with the crank. The body is pulled back into position after dumping by means of a lever and chain. All the operation of dumping and of returning the body into position is effected by the driver without getting down from his place in front. The great advantage of this cart is the extreme facility with which it is loaded. A saving of a foot and a half in the distance through which every shovelful is lifted means a great deal in the course of a day. It is also especially adapted for removing ashes and garbage. Further particulars relative to this improvement may be obtained by addressing the patentee, Mr. A. H. Smith, Station F, New York City.

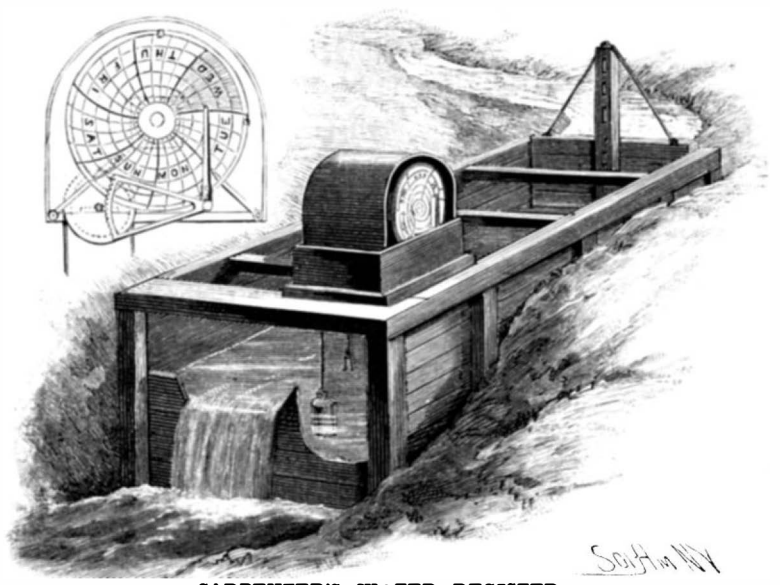


SMITH'S DUMP CART.

© 1892 SCIENTIFIC AMERICAN, INC.

AN IMPROVED WATER REGISTER.

The accompanying illustration represents an apparatus for indicating and recording the rise and fall of a body of water, and is designed to be especially useful in localities where irrigation is resorted to, the machine being placed in a flume leading from the irrigating ditch, and keeping an accurate record of all variations of the depth of the water. This improvement has been patented by Mr. Don A. Carpenter, of Fort Collins, Col. The mechanism of the machine, as shown in the small sectional view, is preferably inclosed by a case. Upon a shaft carrying a grooved pulley is a cable, to one end of which is attached a float and to the other end a counterpoise, the counterpoise taking up all the slack of the cable, so that the shaft is moved with every rise and fall of the float. A pinion on the shaft meshes with a segmental rack on another shaft carrying an arm to which is secured a bar having at its upper end a stylus or pen. The point of this stylus presses against a dial, preferably of paper, secured to a metallic disk by clips, the disk having a hollow hub on its back secured to the spindle of a clock, an eight-day clock being preferably used, and the clockwork being so timed that the disk will make but one complete revolution a week. The dial is divided into seven equal segmental parts, to represent the days of the week, other subdivisions representing the hours, while the dial is also adapted to indicate the height of the water in feet. The dial for use in connection with the machine has also been copyrighted by the inventor, it being designed to furnish a standard size machine to be used with a standard size of weir, say three feet, when the dial slips will furnish the means of determining the discharge of water, in cubic feet, for any desired period.



CARPENTER'S WATER REGISTER.

MR. TESLA'S EXPERIMENTS ON ALTERNATING CURRENTS OF GREAT FREQUENCY.

Mr. Nikola Tesla, to whom the English and French scientific public has just accorded a very warm reception, is a pioneer in electric science, and one of those who will have influenced future progress through an almost radical transformation of the old processes and old methods.

Some day we shall have occasion to describe the two alternating current motors devised by Mr. Tesla as long ago as 1888. At present, we shall content ourselves with recurring to his magnificent experiments on high potentials and alternating currents of great frequency, of which we have already given a complete idea in summarizing the communication made by the author on the 20th of May, 1891, before the American Institute of Electrical Engineers.

In the train of this communication, which made a very great sensation in the scientific world, Mr. Tesla, acceding to the pressing solicitations of his friends and admirers, came to Europe and performed at London on February 3d, and at Paris on the 19th of the same month, before the French Society of Physics and the International Society of Electricians, assembled in the hall of the Society of Encouragement, the remarkable experiments of which we were witness and of which we propose to give an idea, despite the dryness of the subject, its very special character, and our inability to make a clear exposition of it.

Mr. Tesla did not content himself with a simple repetition of the experiments made in America, but he extended them and rendered them complete, and the communications made in Europe may be considered as the second part of a long and remarkable study of which the first part was presented in the New World last year.

In the first place, let us briefly recall the processes employed by Mr. Tesla for the production of alternating currents of great frequency. The simplest consists in the use of an alternator of special form, which is represented herewith in Fig. 2. This consists of a steel disk 30 inches in diameter, upon which are mounted 384 small bobbins, or, more accurately, 384 small zigzag windings. This disk revolves in the interior of a fixed ring carrying 384 inductor poles. The result is that the frequency of the alternating currents engendered by the revolution of the armature before the inductors produces 192 periods per revolution, and that at the normal maximum velocity of 3,000 revolutions per minute, or 30 per second, a frequency of 9,600 periods per second is obtained, instead of the hundred solely that ordinary alternators give. The alternating current thus engendered is collected through the aid of two rings against which two brushes rub, as in all alternators with movable armature. A separate excitation permits of varying at will the alternator's electro-motive force, which, under full excitation, may reach 200 volts. In the second process employed by Mr. Tesla for obtaining much greater frequencies, which may reach and even exceed a million per second, he utilizes an ordinary alternator. In the experiments of February 19, he employed a Siemens alternator, whose frequency did not exceed fifty periods per second.

Fig. 2.—TESLA'S RAPID ALTERNATOR.

The alternating current thus produced is sent to an induction coil by establishing in derivation, upon the primary circuit, a disruptive discharge apparatus formed of a condenser and two polished bars whose distance apart may be varied. This spacing regulates the frequency of the discharges, and, consequently, the frequency of the currents traversing the inductor of the bobbin. The sparks of the disruptive discharges burst forth in a powerful magnetic field which facilitates their rapid production, as well as the cooling of the space wherein they are produced with so great a rapidity. Whatever be the process employed for obtaining great frequencies, the potential is always inadequate, and it is increased by transforming the alternating current by the aid of a suitable bobbin. This latter consists of an internal inductor winding and an external armature winding, formed of relatively coarse wire, and of a number of quite small spirals; for it must not be lost sight of that, seeing the great frequency of the currents, the electromotive force developed for a given length of wire is incomparably higher than with ordinary bobbins. These bobbins have no iron core, and are completely submerged in boiled linseed oil; the object of which is to secure perfect insulation and to prevent the presence of air, which, in this particular case, would be very prejudicial through the considerable heating that it would produce under the action of the enormous and frequently reversed electrostatic tensions to which it would be submitted.

In order to obtain powerful effects, Mr. Tesla overcomes the prejudicial effects of self-induction by utilizing the properties of condensers properly interposed in the circuit of the alternator or in derivation upon the terminals of the disruptive discharge apparatus.

A certain number of the experiments made by Mr. Tesla on Feb. 19 were merely a reproduction of those that we have spoken of before. We shall therefore not reproduce them, but shall dwell more especially upon those that present a character of novelty.

The first experiments were made with the disruptive discharge apparatus, that which gives the greatest frequencies at present obtainable by the means at our disposal. In these conditions, the electrostatic discharges traverse the air under the form of luminous discharges, as if the air were rarefied. On interposing an ebonite plate, the electrostatic capacity of the system formed by the two balls between which the discharge takes place and the ebonite plate is increased by the interposition of a dielectric whose specific inductive capacity is greater than that of the air, and the brightness of the discharges is thereby intensified. These discharges easily traverse long tubes containing rarefied gases, which they illuminate with a bright light, each rarefied gas giving to the light its own distinctive color. The discharges occur likewise between two cotton-covered wires insulated from each other and put in connection with the two terminals of the bobbin. These wires emit a violet light throughout their entire length, and even render luminous the space comprised between them.

All the other experiments were made with the alternator shown in Fig. 2, which gives from 9,000 to 10,000 periods per second. Mr. Tesla first showed the discharges in the form of a flame.

In order to prove that these discharges of high potential and great frequency are not dangerous, he was able, on taking in his hands two metallic balls designed to prevent his being burned by the spark, to receive the entire discharge from the bobbin, the discharge passing through his body interposed between the two balls. Mr. Tesla afterward showed that the return wire is absolutely useless for making the discharge current pass. The latter may be established by the air, and pass more easily if care be taken to connect one of the extremities of the wire of the bobbin with a conducting plate insulated in space. The molecular bombardment heats the part which presents but little sur-

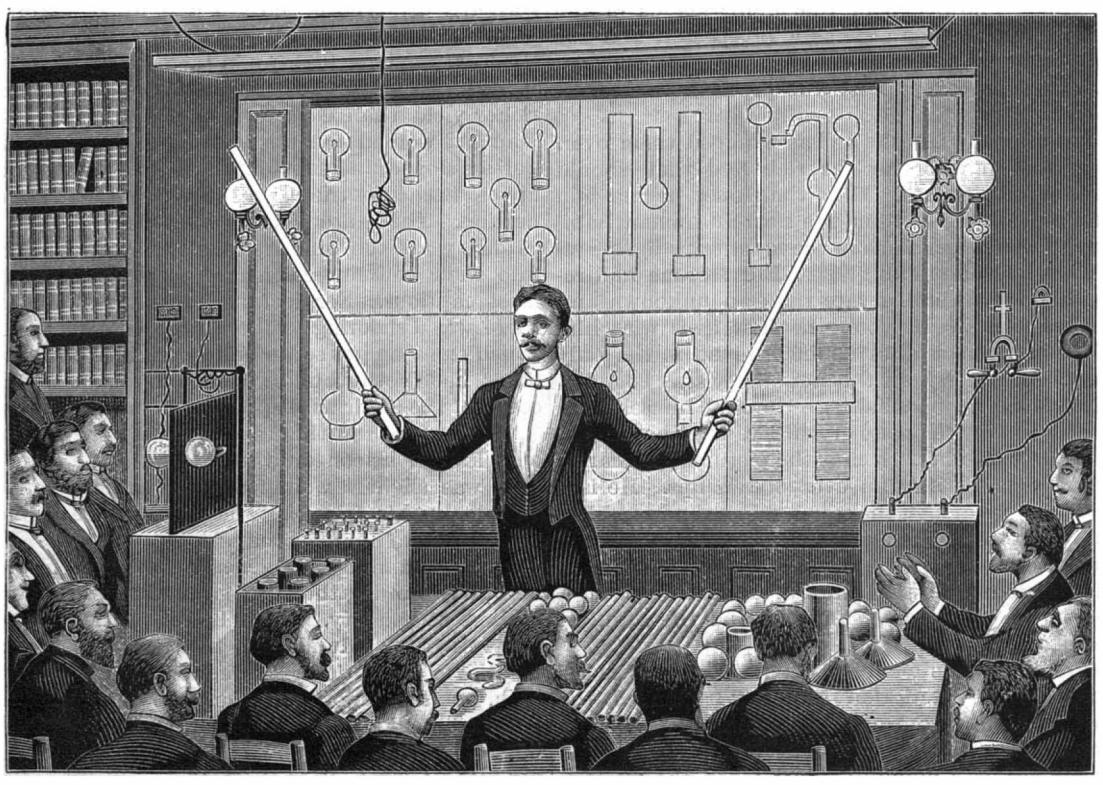


Fig. 1.—PARIS—MR. TESLA LECTURING BEFORE THE FRENCH PHYSICAL SOCIETY AND THE INTERNATIONAL SOCIETY OF ELECTRICIANS.

© 1892 SCIENTIFIC AMERICAN, INC.

face put in communication with the second pole of the bobbin, and it was thus that Mr. Tesla showed us the incandescence of a thin platinum wire or of a carbon filament inclosed in a globe of rarefied air.

Every increase in the capacity of the system increases the discharge current, and, consequently, the incandescence. It suffices, for example, to bring the hand near the globe containing the incandescent body, and to place a metallic shade above the latter, or even (an effect paradoxical in appearance) to place the shade alongside of the globe, to produce an increase of brightness resulting from the increase of the electrostatic capacity.

The wire to which the filament is attached is connected, as we have said, with the secondary wire of the bobbin, whose other wire communicates with an insulated metallic plate. Such metallic communication is not indispensable. In fact, if the wire is covered with lead, a layer of gutta percha entirely insulating the copper wire and the leaden tube that envelops it, the lamp with a single filament becomes lighted as brilliantly when it is put in communication with the copper wire or the leaden tube.

Mr. Tesla thus actuated a Crookes electric radiator, and even a special single wire motor, to describe which would lead us too far. He afterward illuminated certain bodies that are but mediocre conductors, such as alumina, carbon, lime, "carborundum," and a few phosphorescent bodies, such as sulphide of calcium, yttria, sulphide of zinc, and the ruby, the marvelous effects of which several times gained the unanimous applause of the spectators. Mr. Tesla finally terminated with a few experiments in the illumination of tubes of rarefied gases without wires or electrodes, the tubes being simply placed in the periodical electrostatic field produced between one of the insulated poles of the bobbin on the one hand and an insulated metallic plate placed above the experimenter and communicating with the other pole of the bobbin on the other hand.

Fig. 1 shows one of these experiments, in which Mr. Tesla is producing the illumination of two tubes at once. In order to effect the extinction of one of these tubes, it suffices to interpose a middlingly conductive screen in the electrostatic field, or to place the tube in a direction sensibly perpendicular to the flux of induction of the field. The same tube remains dark in all positions if it is held by its two extremities at once, the body forming a screen. On sliding the hand along the tube, it is possible to render one of its extremities luminous. Nothing is more curious than to see the light produced by this process thus extinguished and relighted at will.

Such are, very briefly described, the principal experiments which, for more than two hours, deeply interested the members of the two societies mentioned above, who had the good fortune to be present at Mr. Tesla's lecture.

It would be difficult as yet to say what future is in store for them from the standpoint of an industrial, utilitarian and practical new mode of production of light. The more so as the dream of the inventor is broader and his views more exalted than the experiments that he presented to us allow to be seen. His final ambition appears to be to transform the energy of the medium that environs us, and which is very evident by its numerous manifestations, into light, or at least to obtain therefrom radiations of the same wave length and same frequency as those that produce luminous sensations. Crookes' radiometer has already proved that it is possible to convert the radiant energy of a medium directly into mechanical energy, and although, from the standpoint of rendering, this radiometer is the most detestable of all transformation apparatus, it is none the less the most admirable, by the fact that it affords us a tangible demonstration of the possibility of such transformation.

On the other hand, Mr. Tesla, in his memorable experiments, has shown us that, on periodically varying, with very great frequency, an electrostatic field, it is possible to place apparatus of great simplicity therein, such as tubes of rarefied gases, which collect a portion of such energy and render it luminous. To the philosopher and savant nothing more is necessary to establish the possibility, if not the probability, of the realization of Mr. Tesla's final views. To him the light of the future resides in the incandescence of solids, gases, and phosphorescent bodies excited (if we may use a somewhat vague expression) by high potentials varying with very great frequency.

The young scientist is convinced of this as a precursor, and almost as a prophet. He introduces so much warmth and sincerity into his explanations and experiments that faith wins us, and, despite ourselves, we believe that we are witnesses of the dawn of a near-by revolution in the present processes of illumination.
—*E. Hospitalier, in La Nature.*

THE philosopher known to fame as Sir William Thomson has joined the ranks of the British aristocracy under the new name of Lord Kelvin. This lord lately took his seat in the House of Lords, being introduced by scientific nobleman Lord Rayleigh.

Creede, the New Mining Town of Colorado.

Creede, though only six months old, is to-day the banner mining town of Colorado. The railway reached there in October last, but passenger trains did not run until December. The camp is situated in a narrow gulch on Willow Creek, among the mountains, 9,500 feet above the sea level. The rugged mountains rear their summits 4,000 feet above the town. The new camp is without any definite government, for by a blunder of the State officials it is No Man's Land, belonging to no county or town.

The town proper is about one and a half miles long, and varies in width from 100 to 2,000 feet.

The extent of the mineral belt is unknown, but men who have prospected through all this country express the belief that it runs as far northwest as Carson, forty miles distant, and at least five miles southwest, by ten miles in width.

The principal mines of the camp and the dates of their discovery are as follows: The Last Chance and Amethyst are located on the same vein, adjoining end to end. Both the Last Chance and Amethyst are mines without dumps.

All the ore taken out is shipped, and every bit of mineral between the walls is mined. The vein shows a maximum width of twenty feet, with an average of eight. On the Last Chance a level run from the ore house is 200 feet in length. At the breast five feet of ore are exposed, averaging 185 ounces silver per ton. At the mouth of this tunnel a shaft has been sunk sixty feet, and another level run in from that 130 feet, all in pay ore. At the breast of this tunnel the assay value is only $40 worth of silver to the ton. A million dollars' worth of ore is now blocked out in this mine, and they are shipping seventy tons per day that will average $120 worth of silver to the ton.

In the Amethyst the ore is identical. They have been running north, and have a larger body of ore exposed than in the Last Chance. A drift in this mine 250 feet long shows ore the entire distance of an average assay value of $225 to the ton, and a width 12 feet between the walls. No stoping has yet been done, as enough ore is mined in simple development to pay handsome dividends. These two mines constitute one great ore body, showing over $2,000,000 in sight.

The Holy Moses was discovered in June, 1891, and has been continuously worked since. The ore is similar to Last Chance, but of much poorer grade. It is strongly believed by many experienced miners in the camp that the body of pay ore in the Holy Moses has been practically worked out.

The Ethel mine was discovered in June, 1890. It is shipping a little ore, but of so low a grade that the mine cannot be classed yet as a dividend payer.

The Mammoth was discovered in May, 1890. It has had some very rich ore, but is not shipping at present. It is commonly accounted a huge property, but some of the pessimists express the belief that the ore body is limited.

The camp is named from W. C. Creede. His has been an eventful career. Of all the thousands who have crowded to the new mines not one has a more interesting history or personality than this modest, unassuming miner. He is as timid and bashful as a schoolgirl. He is a reserved, taciturn man, but his whole air is commanding. The few words he speaks are characterized by great good sense.

He is well built and muscular, and is now 49 years old. Fort Wayne, Ind., is his birthplace. At 19 he became a scout in the regular army, and served for seven years in the Indian country. Thus he acquired considerable knowledge of the mining lands of the West. In 1869 he began life as a prospector, and has since heard the music of nearly every rill in Colorado. The mountains possess a peculiar fascination for him.

For months and months he has tramped them over, hoping and working for the rich find that should make him independent. More than once he has lain sick unto death, miles from the nearest human habitation. Twice when alone in the mountains the pneumonia has had him in its grasp. But fortune had reserved him for a kindlier fate than an unknown and unmarked grave. His young nephew lives with him in his humble mountain cabin, and he is the only human being in whom the new silver king confides. Mr. Creede has no bad habits. He says himself that he does not know the taste of whisky. Neither knows he aught of gambling. Such is the picturesque character whose name is now on everybody's lips. He is a general favorite among the rough miners and gamblers of this conglomerate settlement. Modest, pure-minded, courageous, generous to a fault, yet the possessor of untold millions and the acknowledged leader of a settlement of cutthroats, gamblers and the scruff of civilization generally.

His great find was made in May, 1890. This is his own interesting description of it: "I climbed the mountains along the trail of the float all day. The sun was beating down on me and the glint of the float under my feet was blinding. Just when the western sky was tinged with that gorgeous red we see here sometimes, I lifted my head, and there was, projecting out in front of me, a huge bowlder of silicate, big as a house. Good God! I almost screamed with delight. I knew it was bound to come some day, but the idea of finding it in such shape was appalling to me. I staked off a mine and called it the Mammoth. I slept sounder that night than I had for years before. In June I discovered the Ethel and the Holy Moses. I gave the latter that name because I like odd names." Mr. Creede's income is now about $1,000 a day, none too great a reward for a lifetime of toil and perseverance.

Only a little less remarkable has been the life of Captain L. E. Campbell, Creede's partner. In 1861 he joined the army and did good service during the rebellion. At the close of the war he became a second lieutenant in the Indian service. His Western experience has given him a great knowledge of mineral lands. He married the daughter of Colonel Fred Dent, brother-in-law and confidential friend of General Grant. As a girl she spent much of her time at the White House. She now displays the same charming grace in her husband's rude cabin that she did at the White House. For years Captain Campbell has been supporting his family on the scanty pittance allowed an army officer. Henceforth he will enjoy an income almost fabulous. Creede is a typical Western town. Its seething, diversified population has come from everywhere. Never since the palmiest days of California in '49 has anything of the like been seen. The scum of Western life is here, along with much of its sturdiest element. Faro dealers, arm in arm with Denver speculators, may be seen in the streets at any hour. The tenderfoot lately from the East is an easy prey to the gamblers and sports. Assassins and honest men hobnob like old acquaintances. Desperadoes from Kansas, confidence men, horse thieves, a Harvard graduate of law, and an escaped convict from Texas, may be seen sitting together on a footing of democratic equality at the faro tables. Such is the drama of Western life as seen here. Every one is engaged in a wild scramble for money. The shining metal has attracted all—fallen women, gaming men, lawyers, miners, desperadoes and tenderfeet.

Excitement reigns among all classes. The camp now numbers 15,000 souls, and fully one-half of that number are gamblers. It is a gambler's paradise. The tables are crowded night and day. Fortunes are made and lost in an hour. Faro, keno, stud poker, and craps are the popular games. The miners make about $3 a day and 500 out of the 600 employed hereabouts spend every cent of their wages over the green cloth on Saturday night. Billy Woods, the champion heavy weight prize fighter of the West, runs one of the gambling hells. Every bartender in the town is an ex-pugilist.

Thus far fairly good order has been preserved in camp. Beyond the frequent killing of a stake jumper, and innumerable saloon brawls, the deeds of lawlessness have been comparatively few. It is highly improbable that this quiet state of things shall long continue. Bob Ford, the murderer of Jesse James, is here. He professes to have come to make money. But in a recent interview he was careful to let it be known that he is still able to take care of himself in any quarrel. Bat Masterson, a noted frontier marshal, is the manager of a gambling house. He is one of the nerviest men in the West, and it will go hard with any gambler who raises a row in his establishment. Masterson has already killed twenty men. Others equally well known are in town, and the future peace and order of the place does not look assuring.

There are now published in Creede three dailypapers—the *Amethyst*, *News*, and *Candle*. They are all sprightly little sheets and are a daily reflex of camp life. Let a new claim be staked off in the snow, and the local papers write it up in the most elaborate style, being always scrupulously careful to predict for it a richer yield than Comstock or Molly Gibson. Every man and woman in camp of any note considers the reporters slow or incompetent if his or her name doesn't appear in each of the papers every evening in some connection. The editors know what class of news their readers want, too, and are careful that nothing creeps into their columns calculated to give offense to the most captious. For instance, about two weeks ago there was a shooting scrape in the Orleans saloon, in which one man got seven bullets put into him and another had both thumbs shot off. This is the account of the affair as it appeared in one of the papers:

"We understand that several shots were fired near a well known saloon on Cliff Street, last night. One man was slightly wounded and has been carried to Pueblo by his friends. The boys will have fun, but don't mean to hurt anybody."

Notwithstanding the general prevalence of wickedness and disorder, there is a strong law and order population in the city. Capitol Hill is the residence of Creede's Four Hundred. The residences are not palatial or pretentious. Three of them are two stories high, but the majority of them are only one, and the most commodious contains only three rooms. They are built of green lumber, and, of course, when the summer sun gets a fair whack at them, there will be a shriveling and a shrinking that will make them all the more picturesque. And, too, their foundations are rather

© 1892 SCIENTIFIC AMERICAN, INC.

groggy affairs, but they fulfill all the present conditions, and that's all the most exacting of the Creede 400 demand at this chrysalis stage of the young metropolis' development. On the evening of February 22 a grand ball was given by the *elite* of the town.

All the ladies were dressed in handsome ball costumes, and the *decolleté* gown was there in force. The men—or a great many of them—wore the conventional swallowtail broadcloth.

Living in Creede is very expensive. A meal costs $1. Beer costs 15 cents a glass, or 80 and 40 cents a bottle. Whisky that will not kill cannot be got for less than 25 cents a drink, and the bartender is careful that your libation is not too large at that. Horses or burros to ride over the mountains are hired at 50 and 25 cents an hour. The streets are so terribly sloppy that one dares not walk around much, and a ride to any part of the city will cost you 50 cents. Cabmen have driven over from Pueblo, a distance of twenty miles, with their rigs and are reaping a richer harvest than the prospectors. Labor is high. Any man who can drive a nail can command $4 a day, and in some extreme cases they are paid $1 an hour. Boss carpenters get $8 a day and are talking of raising the scale of wages. Laundry costs three times as much as in St. Louis, and no Chinamen are allowed in camp.

Hotels are numerous, there being nearly 100. It does not, however, take much for a hotel, as a plain board shanty, 16 ft. square, with a blanket for a door, is dignified with the name "Palace Hotel." Until a short time ago the hotels were similar to this one, although many of them were made larger. In all, the sleeping room held from twenty to sixty cots, the use of which was granted the tenderfoot at $1.50 each a night, with blankets furnished, or without blankets only 50 cents. The Pullman company has also entered the hotel business, leaving on the side track from three to ten sleepers, in which the anxious speculator could find a bed on payment of $1, provided he could catch the conductor in time to pay in his money and secure his ticket.

A shocking state of sanitation prevails. Water for washing, cooking, and drinking is obtained from Willow Creek, which is also a sewer and dumping place for all the refuse of the camp. An epidemic of dysentery has just broken out. It is claimed the trouble comes from the arsenic and antimony from the ores poisoning the water. There are 200 persons in town afflicted to-night, and many cases are quite serious.

The peculiar cough which catches hold of nearly everybody who comes to Creede is attributed to the arsenic in the air.

Speculation in town lots still continues. The latest report is that the United States land commissioner has ordered a discontinuance of all land sales. Governor Routt and other State officers assisted at the sale on February 25. The claim holders intimidated outsiders and had things pretty much their own way. Women were among the bidders.

A lot was put up, the minimum price being $50. Some one said, "A woman occupies it;" then the crowd shouted, "Give it to her." One man bid $50. The crowd groaned and hissed, and the man bid $1, announcing that it was for the woman, and that no man had the temerity to raise the bid. The lot was knocked down to the woman amid a storm of cheers.

A lot occupied by a poor woman was bid in by a liberal man and given to her. This established a bad precedent. A corner lot on block 17 sold for $1,100. The next lot was claimed for a "lady." One or two people began to bid, but the crowd hissed them down. The lot was knocked down for her at $160. It was stated that she made her first appearance only the day before on the grounds.

A few minutes later a woman got up on the Squatters' Committee stand and made her own showing. Mrs. Barry was her name. She said she had been begging for two days and was living on the lot. The woman wore an astrakhan fur jacket and her fingers resembled a jeweler's showcase. First she was cheered by a clique, and then a roar went up to give her the lot. She got it. It was certainly surprising to know that there was so many "lady squatters" in Creede. No one was aware that there were half so many in town.

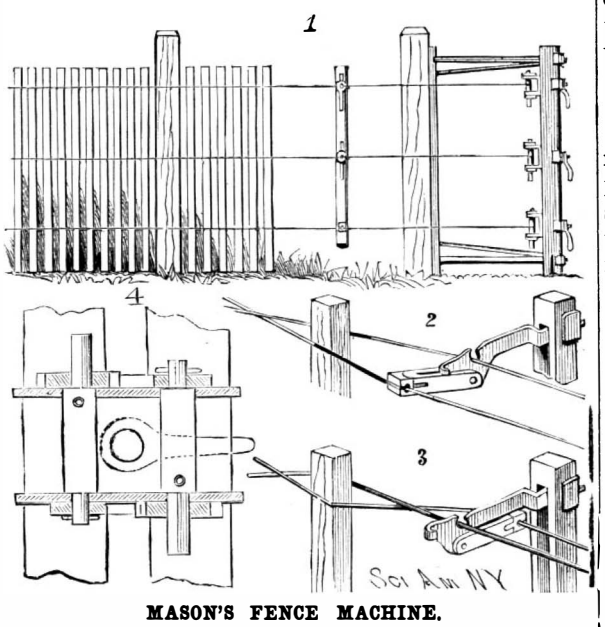
The highest price paid was for a corner, which sold for $2,700.

In all $225,000 was realized. An attempt was made to rob the State officials of the money. But a mob of 1,000 men, armed to the teeth, immediately surrounded the governor's train and guarded it overnight.

Mrs. Marie Love is among the women who are making thousands at Creede. Almost any day, when the sun's rays are playing hide and seek with the snow crystals on the mountains and cliffs, Mrs. Love can be seen astride a burro riding over the hills in search of leads. She has staked off five claims, some of which old prospectors declare will make her the silver queen. Woe to the man who would dare jump one of her claims, for the camp would rise up *en masse* and tear him limb from limb.

Mrs. Love is a finely educated woman, of majestic bearing and business-like deportment. She is of magnificent physical development and her face is of a decidedly classic mould. She dresses in severely modest colors, her large hat with its great black plume being the only conspicuous feature of her attire. She is splendidly posted on all current topics, and discusses politics and politicians with the intelligence and originality of a veteran statesman. She is closely related to some of the most distinguished people of Ohio, Indiana and Pennsylvania, and as soon as she can convert her newly acquired mining property into anything like its cash value, she intends to purchase an elegant home in Washington, so that her children may enjoy the advantages of the social life of the national capital.

The law and order element of the population of



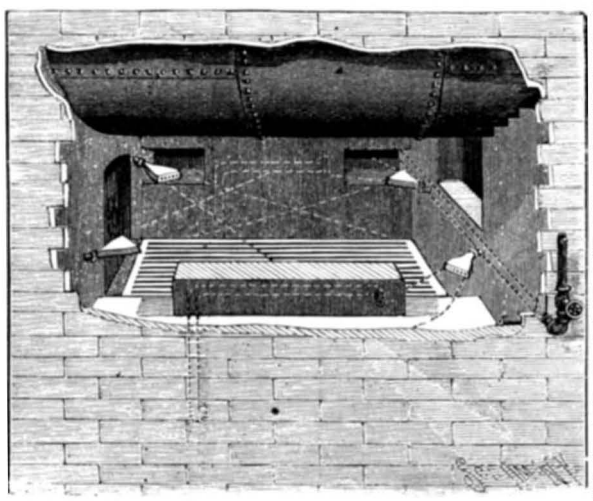
MASON'S FENCE MACHINE.

Creede is growing stronger daily. At a citizens' meeting held the other night resolutions were passed providing for the public safety. New strikes of silver are being opened daily.

Word comes from Criple Creek that that camp is enjoying much the same scenes as Creede. There, too, gamblers of all sorts are reaping a rich harvest. Neither has it a government. A vigilance committee runs the town.

The foregoing is from the *N. Y. Press* and the following we find in the *Electrical World:* Many have read the announcement which has been made that "Creede, Colo., has electric lights," but few are aware of the phenomenal time occupied in the construction of the plant, due to that element of vitality and grit which is most noticeable in Western people.

The idea of equipping the plant was conceived at noon, Feb. 1, by John W. Flintham, general manager of the Denver Consolidated Electric Light Company. Before the day was over, the Creede Electric Light and Power Company was organized and incorporated, supplies were ordered and placed aboard a special train of cars at Denver that had been chartered from the Denver & Rio Grande Railway Company, and everything necessary for the complete equipment of a model electric light plant, for arc and incandescent lighting, by midnight of the same day was on its way to the modern mining camp. Creede was in sight Tuesday night, Feb. 2, and by daybreak the following morning



HUGHES' FURNACE.

a gang of laborers was put to work breaking ground and getting the foundations of the power house ready. By this time the town was alive with interest in the work and pool sellers were offering odds on the time to be occupied in completing the plant. The work progressed night and day and the electric current was turned on at 11:15 P. M. Saturday, Feb. 6. The actual time occupied in completing the plant, erecting the buildings and placing the machinery in position, was from Feb. 3, 7 A. M., to Feb. 6, 11:15 P. M., less than a week after the machinery was purchased in Denver, over 300 miles away, and this young town was given the latest luxury of civilization. Arc and incandescent lamps illuminate gorge and mountain side, and the hum of the dynamo recalls the mind of the seeker after riches to an occurrence without a parallel in electrical history.

The magnitude of the undertaking will be understood from the following inventory of the plant: Two boilers, 100 horse power each; one Armington & Sims high speed engine, 100 horse power; one pump; one dynamo of 30 arc lights; one 400 incandescent light dynamo and two 50-foot iron smokestacks.

Since the house was completed another dynamo of 60 arc light capacity has been added, and the company will increase the capacity for incandescent lamps to 1,000 as quickly as the machinery can be set, and the capacity of the plant will be increased as quickly as there is any demand for more light or power. The value of the plant is said to be from $35,000 to $50,000.

AN IMPROVED FENCE MACHINE.

The illustration represents an apparatus designed to facilitate the building of picket fences, in which the pickets are held between strands of wire secured to suitable supporting posts, one man readily working the apparatus to quickly and nicely build a fence. The improvement forms the subject of a patent issued to Mr. William H. Mason, of East Monroe, Ohio. Fig. 1 shows the apparatus connected with a partially built fence, Figs. 2 and 3 showing details of the wire twister, and Fig. 4 being a sectional view of the tension regulator. The latter consists of a frame carrying rollers, to which the ends of the wires are attached, one end of each roller being adapted to be turned by a crank, and the rollers being carried in pairs by U-shaped clips. Each roller has at one end a ratchet wheel, and at the opposite end a pawl, the pawl of one roller engaging the ratchet wheel of the opposite roller, the two pawls serving to prevent the rollers from turning in the wrong direction. When the tension regulator is secured in position opposite to one of the end posts of the fence, the free ends of the wires are secured to the rollers, and these are turned by cranks to tighten the wires to any desired extent. The twister has projecting main arms, with recesses in their upper edges to serve as hooks to receive strands of wire, and on each main arm is pivoted another arm, having a joint recessed to receive a strand of wire. One strand of each wire is placed in the recess of the main arm, and the opposite strand in the recess of the pivoted arm, and after the twister is once adjusted it need not be taken from the wires until the fence is built, as it may be pushed along in front of the pickets as fast as they are placed in position. Fig. 2 shows the twister in position to force two wires apart, to allow a picket to be placed, and Fig. 3 shows the wires crossed by the twister after the picket has been inserted. Should the wires become too taut after the insertion of many pickets, the tension may be slackened by loosening the nuts on the bolts to which the roller-supporting clips are pivoted.

AN IMPROVED FURNACE.

The furnace construction of which a section is shown in the illustration is designated by the inventor as a steam blower smoke consumer, and is designed for use in connection with steam boilers, puddling and heating furnaces, etc., or for any similar purpose where steam pressure is available. It has been patented by Mr. Christian B. Hughes. In the front end of the fire box is the usual inlet door, and at the rear is the usual bridge wall, while in the side walls are arranged longitudinally extending chambers or channels opening at their ends into the fire box above the grate. In the front wall of the fire box are nozzles for the discharge of superheated steam obliquely above the grate about in line with the longitudinal chambers, there being in the rear of the fire box a similar set of nozzles below the upper end of the bridge wall and in line with the rear openings of the channels. In the wall between the longitudinal channels and the fire box are air pipes or ducts leading from the ash pit into the channels, to supply the latter with heated fresh air. The amount of superheated steam passing to the nozzles is regulated by a valve, the jets from the front nozzles driving the burning gases, smoke, etc., rearwardly, while the jets from the rear nozzles force the smoke, etc., into the rear openings of the longitudinal channels, where they are mixed with hot air from the ash pit, the mixture again entering the front end of the fire box to be passed over the burning fuel. The smoke and gases not thus consumed are again driven through the side channels, to be forced again over the burning fuel by the jets from the front nozzles, the continuous operation insuring a complete combustion of all the gases.

Further information relative to this improvement may be obtained of the Niles Electric Light and Power Company, Niles, Ohio.

BELTING having joints cemented only is as good as if the belt were formed of solid leather from end to end. It lasts much longer, and drives better than when cut up with sewing.

© 1892 SCIENTIFIC AMERICAN, INC.

THE WESTERN UNION CENTRAL TELEGRAPH OFFICE AND PLANT IN NEW YORK CITY.

On July 18, 1890, the upper stories of the main building of the Western Union Telegraph Company, in this city, were destroyed by fire. The experiences of such disasters have shown that water is one of the greatest enemies to switch boards and general telegraph plant. The new portions of the Western Union building replacing the portions destroyed have now been practically finished, the operating room is in full operation, and to-day it is the second largest telegraph office in the world, and possesses a plant protected, as far as possible, not only from fire, but also from water. We illustrate more particularly the operating room and electric current generating plant.

Two thousand one hundred and fifty wires at present enter the building through underground conduits. The wires are bunched in cables of 100 conductors each, and are received by a slate terminal board, carried in an iron frame, with the capacity of nearly 1,100 more wires than it at present accommodates. This board is situated in the basement of the main building. The cables are carried thence each through a separate three inch pipe, by way of two fire-proof shafts, up to the main operating floor, where they are distributed wire by wire.

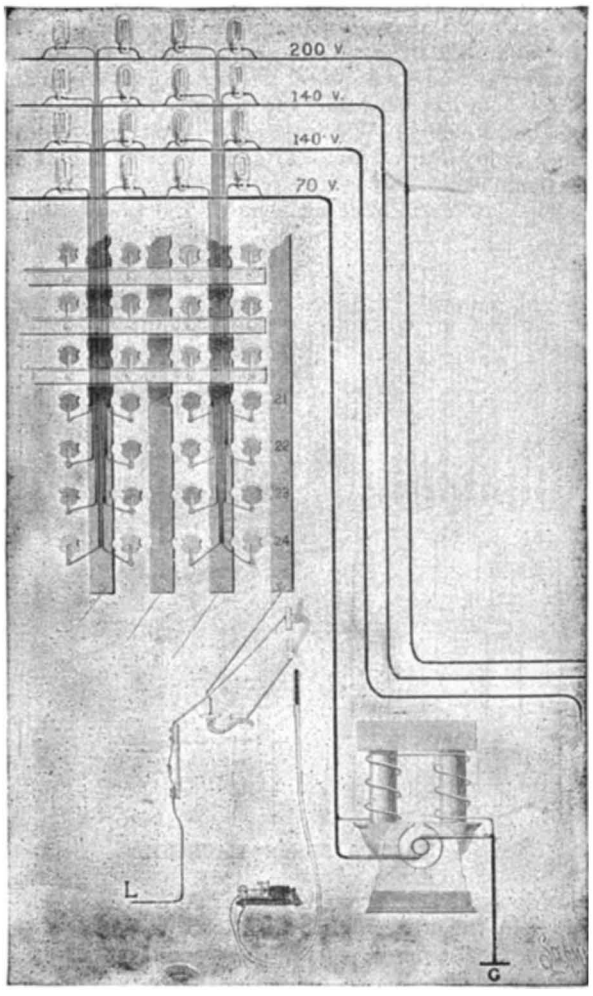
The floor is of the ordinary fire-proof type, consisting of H-iron floor beams, with brick arches between them. Upon the floor, after being leveled up, wooden moulds were laid and concrete was then run in to surround them. The wooden moulds were of shape and length to produce a series of gutters running over the floor in different directions, according to the plan of the operating tables and switch boards. After the concrete had hardened, the moulds were removed, leaving open ducts or channels traversing the room in all directions. The channels are covered by slabs of slate, 13 inches wide and 1 inch thick, which can be removed for the introduction or removal of wires or for repairs or alterations. The rest of the floor was brought up to the level of the slate by rock asphalt, leaving all level and true.

The ducts thus made are from three to five inches deep and ten inches wide. The intersections come under the center of the operators' tables. At each intersection a 13 inch square hand plate is placed that can readily be removed for reaching the wires. Even from the tables to the floor where the wires rise to the relays and sounders they are protected by being cased in split iron pipes.

Our general view of the main operating room shows the distribution of the operators' tables and, to that extent, illustrates the general plan of the ducts. The wire is copper of Nos. 16 and 18 B. W. gauge. All joints are soldered and insulated with the same care as is bestowed upon a cable, a special detail of the company's cable crew having been appointed for this work.

The current is generated by dynamos which are distributed in three groups each of five machines placed in series for the regular work, while for local and special service six other dynamos of 6 volts, 23 volts and 45 volts difference of potential are provided. These dynamos replace all batteries. At present there is not a single cell in operation in the building. Before the fire there were 10,000 cells in use.

In our illustration of the dynamos and of their connections, the three groups of five dynamos are indicated by being numbered from 1 to 5. They are connected in series, so that the terminals from the different machines which are led to the plug disks which regulate the distribution to the switch boards rise in potential for each one. The potentials are named from their numbers the first, second, third, fourth, and fifth potential respectively. The field for the entire group of dynamos is supplied by the fifth machine. All the fields are



SWITCH BOARD CONNECTIONS.

connected in parallel, and for each field a resistance box is intercalated for individual adjustment of its field. The right hand group in the cut is a reserve group, designed to replace either of the others when they have to be suspended from operation. It is to be observed that the two left hand groups deliver the current in opposite directions, some wires being supplied with current of one direction and others with that of another. Hence, the right hand group designed to replace either of the others has to have arrangements for reversing its polarity. This is effected by reversing the terminal connections of the fifth machine. This necessarily causes this machine to deliver its current in the opposite direction, but, as the fields of the other four machines are supplied by the current from the fifth one, and as this current is reversed, the current in these machines is, by the same action, reversed, on account of the change of polarity of their fields.

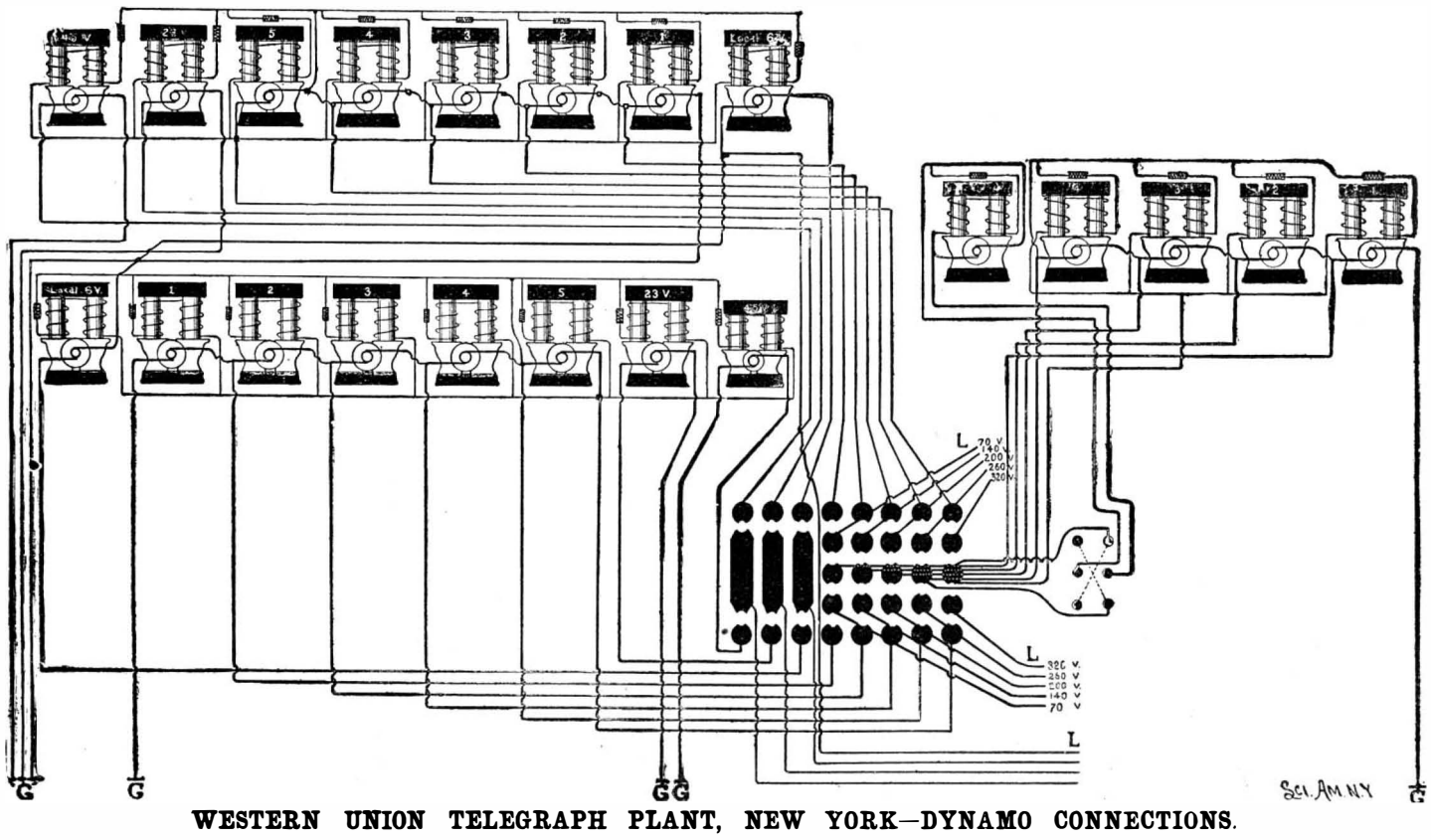
By means of the disks and plugs the dynamos are plugged in or out as desired. On the same drawing are indicated the different potentials for each wire, the first two dynamos being of 70 volts each and the others of 60 volts each. The special dynamos are plugged in as required by special plug switches, shown on the left of the main group.

The current thus generated is received at the switch boards, which are seen in the drawing Fig 3, on the left of the main operating room, and one of which is also shown in Fig. 4 of the drawing and in the special view on this page. For ordinary purposes, the first three potentials only are used, the fourth and fifth being for quadruplex and similar work. As the current comes from the dynamos, it is received by four leads or horizontal bus wire seen at the top of the switch board. The lower one represents a 70 volt potential, the next two represent 140 volts each, and the other one 200 volts potential. From the bus wires leads descend to the disks of the switch board. For each potential, a special lamp is used, through which the current has to go before reaching the disks, and which introduces resistance. In operation the filaments of these lamps glow with a dull red. Should any abnormal current, due to grounding, go through the line, the lamp immediately burns brightly, showing trouble upon the line in question. This brightening of lamps is always watched for. A special type of lamp is used containing one filament, two filaments in series, and three filaments in series respectively, according to the resistance desired. At the dull red glow, they carry $\frac{6}{10}$ of an ampere current. By plugs, the disks and bars of this switch board can be connected in the most varied ways, in order to bring about almost any connections. From each vertical bar a wire runs to the lines, and in the course of this wire two spring jacks are placed. Each of these spring jacks can accommodate four wedges. By introducing a wedge with two metal faces and an ebonite center, it will be seen that a loop can be put into the line. The switches are so constructed that four of these loops can thus be introduced, each one in series, so that each line can have eight loops all in series connected with it. Thus, by proper connections, it will be seen that there is hardly any limit to the combinations which can be brought about. A single loop leading to a relay is represented in the drawing.

SAFETY FUSE.

In the cut of the switch board connections will be noticed a safety fuse, shown of about the natural size above. These are known as "W. B. G." protectors. They consist of a short piece of No. 20 fuse wire. Around its end, No. 30 silk-covered German silver is wound a number of times. The current has to go through the German silver wires. Any abnormal current will heat the German silver wire and this heat is relied on to melt the fusible wire. Three-quarters of an ampere is the maximum current that the protector will carry.

In the cut, Fig. 4, the general appearance of the back of the switch board is shown in perspective with the bank of lamps appearing above the disks. An interesting feature is the one represented in this cut. The backs of the switch boards are closed in with glass doors and walls, so as to have the greatest amount of light possible shed upon them. A large hatchet switch is placed on the wall, by which they can all be cut off



WESTERN UNION TELEGRAPH PLANT, NEW YORK—DYNAMO CONNECTIONS.

© 1892 SCIENTIFIC AMERICAN, INC.

in case of any accident. This cutting out is to prevent any injurious effects from short-circuiting, in the case of fire in the building, when the switch board, being wet by water from the fire engines, might give occasion to this trouble were the current turned on.

The general operations of the office are facilitated by the use of the cash carrier railroad and by pneumatic tubes. An elevated gallery occupies approximately the center of the main operating room. An extensive system of cable cash carriers, embracing 16 radiating lines, with four to six stations on each line, connects with all parts of the room. By this the messages are distributed from and returned to the central gallery. The cash carrier runs at the rate of about 750 feet a minute, enabling the most distant part of the room to be reached in 10 seconds. Twenty-four pneumatic house tubes terminate in this gallery; and four street pneumatic tubes running north to 23d Street, and intermediate offices, and four running south to exchanges below Wall Street, are also operated from this gallery. All messages coming in or going out from the main operating room must go through this central gallery.

Fig. 2 of the drawings shows the time repeater. At noon, every week day, the time is transmitted from the United States Naval Observatory at Washington. This signal has to be sent out over many lines in all directions; at present 60 different lines transmit it. The time repeater includes 92 repeating magnets. These are operated on a local circuit, which in its turn is governed by a relay connected to the Washington circuit. The repeating points of the 92 magnets are connected by loops to the main line switches. This apparatus represents a multiplication of relays, and can be used for sending 92 repetitions of one message over 92 different lines by a single operator, and it is contemplated on election nights and similar occasions to thus use it.

The average business done in this office is over 100,000 messages per day. The longest circuit is that extending from New York to San Francisco, about 3,400 miles long. Of the 750 lines leaving the building, the greater part are operated by the Morse system, the majority of the operators' desks seen in the engraving being devoted to this system. Besides this there are four Wheatstone, 42 duplex and 92 quadruplex lines, and two lines occupied by combination printing instruments. The office accommodates about 800 operators. Our thanks are due to Mr. Alfred S. Brown, Electrical Engineer of the Western Union Telegraph Co., for courtesies received.

Improvement in Stokehold Ventilation.

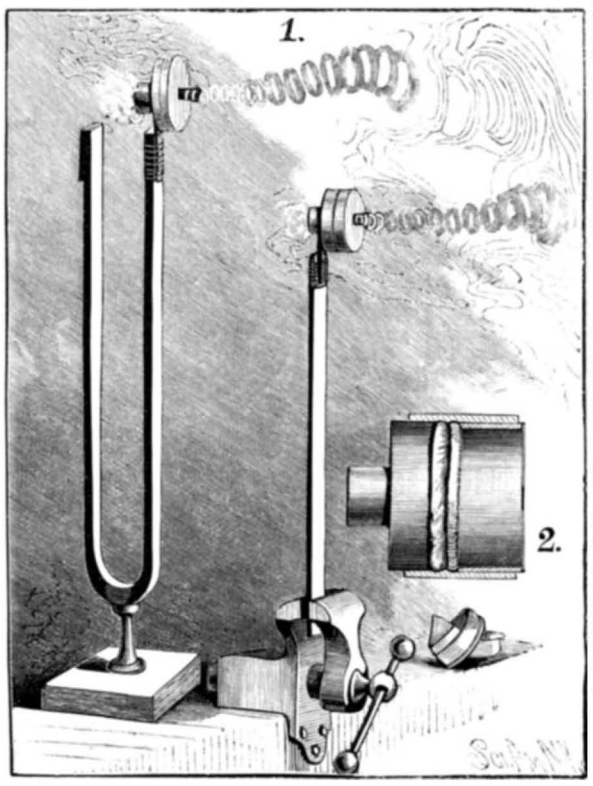
By the system of Mr. W. H. Martin the usual unsightly ventilating cowls on deck are done away with, the necessary down draught being obtained by the utilization of the heat radiated from the main boilers and uptakes. This lighter air is allowed to rise up through an enormous space between an inner and outer funnel, causing a powerful down current of fresh air through the stokehold combing, at the same time thoroughly preventing the rising of any smoke or dust to the deck, as is usual when cleaning fires and quenching ashes. To insure the fresh air reaching the stokehold floor, there is a light air-tight screen or bulkhead built in front of each end of the boilers, reaching from the deck right down to within 6 feet from the stokers' floor, the lower part being on hinges to allow access to the smoke box doors. As the whole of the air drawn off by the annular funnel space, to which is to be added that needed for combustion in the furnaces, has to pass down in front of these air screens, the result is a powerful draught of fresh air at all times, independent of the direction or force of the wind on deck, keeping the stokehold at a temperature considerably l o w e r than in the sunshine on deck, and but from 5° to 15° Fah. above that in the shade. This system, which is much more economical than the fan, is in use on most Dutch steamers trading to the East Indies, and has proved to be of great value.

FOUR electric fans have been placed by the Crocker Wheeler Company in the turrets of the powerful iron vessel Miantonomoh, the intention being that they shall blow away the smoke from the guns.

AN EXPERIMENT IN ACOUSTICS.

BY GEO. M. HOPKINS.

In the annexed engraving is shown a very simple and effective method of indicating visibly the vibrations of a reed, tuning fork or diaphragm. It is not assumed that it can replace any of the existing methods of rendering visible indications of sonorous



VIBRATIONS SHOWN BY SMOKE RINGS.

vibrations, but it adds another very pretty acoustic experiment to the list of those already known.

In Fig. 1 are shown two forms of apparatus which yield practically the same results. In one a reed is clamped in a vise at one end and provided at the other end with slip of wood attached firmly by a wrapping of thread. To the wooden slip is glued an ordinary paper pill box, having a diameter of about two inches and a depth of ¾ inch to 1 inch. In the bottom of the box is made a 1 inch hole in which is secured the end of a paper tube 1 inch in diameter and about 1 inch long. The cover of the box is perforated with a ¼ inch round hole. If the material of the cover is coarse and thick, a larger hole is made and over it is glued a piece of fine thin Bristol board, which is perforated with a ¼ inch round hole.

In the box thus mounted is placed a strip of blotting paper bent into V-shape and rendered non-absorbent at the bend by means of melted wax paraffin or something of a similar nature. One end of the blotting paper is moistened with hydrochloric acid and the other with aqua ammonia. The particles of ammonium chloride which form by the combination of the vapors of ammonia and hydrochloric acid are so minute as to float in the air like particles of smoke.

When the reed is vibrated, a minute vortex ring is formed at each excursion of the box and thrown off in the manner illustrated. A reed having a low rate of vibration (say 32 or less per second) is required, and the amplitude of vibration must be small.

When the box is attached to a tuning fork, the action is prolonged. It is, of course, necessary to compensate for the box on one limb of the fork by a weight on the other.

In Fig. 2 is shown a cylindrical box considerably larger than those already described. It is divided into two compartments by a thin rubber diaphragm, and closed at the front, with the exception of a ¼ inch round aperture. Blotting paper, charged with hydrochloric acid and ammonia, is placed between the diaphragm and the apertured front, and sounds are uttered in the short tubes projecting from the box. The vibration of the diaphragm causes puffs of air to issue from the small aperture at the front of the box, carrying the fumes of ammonium chloride, which render the vortex rings visible. The sounds uttered are necessarily of very low pitch. If the vibrations are too frequent in any of the forms of this experiment, the rings merge into each other and the effect is lost. In the apparatus shown in Fig. 2, a mere flutter of the tongue or lips gives good results.

It is obvious that a burning substance capable of yielding a good volume of smoke will answer quite as well as the ammonium chloride.

DISTINGUISHED ELECTRICIANS.

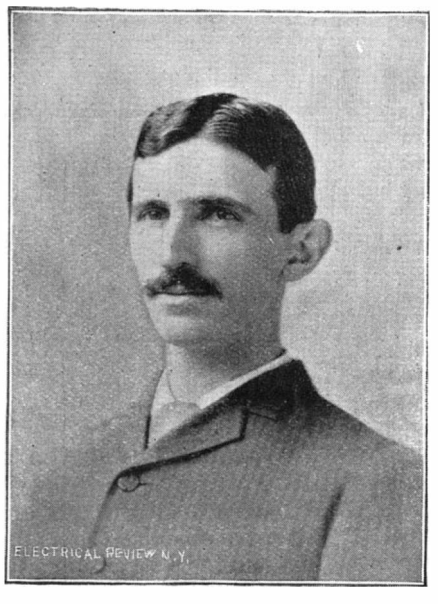
The portraits here presented represent men who, while they have achieved notability in the electric world, have, in so doing, shown that they possessed the requisites for success in any branch of work. Untiring industry, great ingenuity, and a belief in themselves would have made them great in any of the executive departments of life. Thomas Alva Edison's story has been told so often that it cannot but be a trite one. He was born on the 11th of February, 1847, at Milan, Ohio. He began life at the age of twelve as a train boy, soon advancing to be a news dealer with four young assistants. He then began practicing telegraphy, and at last obtained a position in Port Huron. He soon began to invent, and in 1864 he moved to Memphis and had one of his inventions, an automatic repeater, put into service. He struggled along, inventing, working at his profession, and experimenting, until he went to Boston in 1868, where he was able to open a workshop for developing his inventions. Shortly afterward he was retained by the Western Union Telegraph Company, and started an electrical laboratory at Newark, where he employed 300 men. In 1876 he moved to Menlo Park, New Jersey, and in 1887 left Menlo Park and erected in Orange, New Jersey, what is supposed to be the largest experimental laboratory of its kind in the world. His inventions, which are numbered by hundreds, center largely on electricity, although one of the most wonderful of his achievements, the phonograph, is not an electrical invention at all.

Alexander Graham Bell was born in Edinburgh, Scotland, March 3, 1847, being therefore almost exactly the same age as Edison. His father and grandfather were both language teachers, and the y o u n g Bell's attention was directed to language by the course of studies prescribed by his father. The synthesis of artificial speech, by Helmholtz's method, is said to have early engaged his attention, and he resolved to pursue one of the outcomes of his studies, multiple telegraphy,

THOMAS A. EDISON, ORANGE, N. J.

PROF. ALEXANDER GRAHAM BELL, WASHINGTON.

PROF. ELIHU THOMSON, LYNN, MASS.



NIKOLA TESLA, NEW YORK.

DISTINGUISHED ELECTRICIANS.

© 1892 SCIENTIFIC AMERICAN, INC.

to a practical conclusion. It has been said that all this time the idea of speech transmission was an undercurrent of thought with him, and he has testified that, before 1870, he avowed his belief that we would one day speak by telegraph. Going through all sorts of experiments, he succeeded in inventing the telephone. He lectured on it before the Society of Arts, in Boston, May 25, 1876, exhibited it at the Centennial in Philadelphia, and in August of the same year speech, it was said, was transmitted over a telegraph line. He has received numerous honors, and has written numbers of papers on his other scientific work, such as the photophone. He has also, for years, studied the subject of speech for the deaf and dumb.

Elihu Thomson was born in Manchester, England, 1853, and at the age of 5 came to this country with his parents, who settled in Philadelphia, where he was educated, graduating from the Central High School in 1870. He experimented a great deal during his boyhood in electricity and chemistry, photography and similar subjects. Graduating at the age of 17, he spent six months as an analytical chemist in a laboratory, and was then appointed Assistant Professor of Chemistry and Physics in the High School, and was promoted to the chair of Professor of Chemistry and Mechanics in 1876. He frequently lectured and continually experimented during this period, in the Artisans' Night Schools, Franklin Institute and elsewhere. He was associated with Prof. Edwin J. Houston in some patents relating to dynamos, and upon these and other inventions based the American Electric Company, since called the Thomson-Houston Electric Company, organized in 1880, and became chief electrician of the company. His invention of electric welding and brazing has been fully described in the columns of the SCIENTIFIC AMERICAN and SUPPLEMENT. His very remarkable experiments in alternating current induction have done much to win for him an international renown. The air blast applied to switches and commutators for blowing away destructive arcs is a type of his practical way of reaching results. Like Edison, he holds a great number of patents.

Nikola Tesla was born at Smiljan, a small place on the Austrian border, and is now 35 years of age. His education was received at Carlstadt in Croatia; he too showed the experimental bent and eventually entered the polytechnic school in Gratz, Austria. Here he studied engineering and devoted his spare time to studying electricity; on graduation he entered the engineering department of the telegraph at Buda-Pesth, and in 1881 took up the electric light and the construction of dynamo machines as his especial work. He is said to have been greatly impressed by the drawbacks incident to the employment of the commutator and collecting brushes on dynamos and motors. But his recent work and that which has brought his name more prominently before the world than ever before has been with alternating currents. Employing a dynamo giving 20,000 alternations in a single second, he has produced what may be properly termed the most remarkable experimental results recently attained by electricity. With these alternations used in the production of the most beautiful lighting effects, he succeeded in showing or at least in indicating the possibility of producing electric light without any conductors whatever. Two very striking points brought out were the construction of his apparatus. In his transformer he employs a liquid insulator, the point being that the perforations of its material naturally do no harm, as they instantly close up again. Another point was that these currents of high frequency have no effect on the animal system, being apparently perfectly safe, however great their intensity or high the potential difference developed in their circuit.

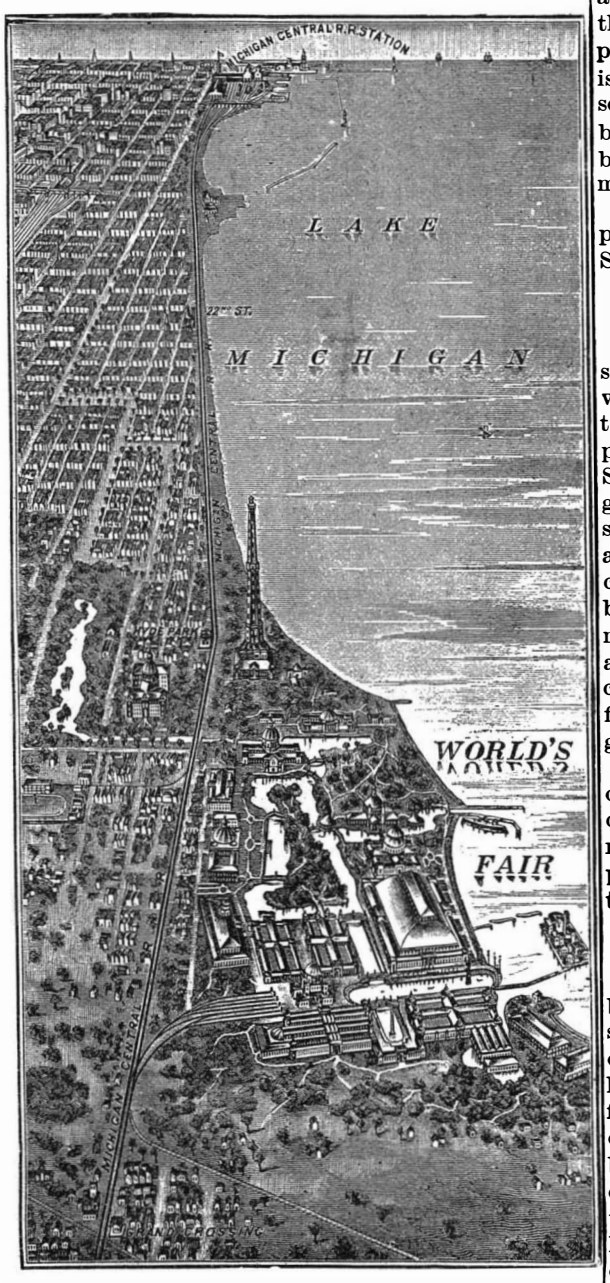
Production of Quicksilver at New Almaden.

The Quicksilver Mines and Reduction Works of New Almaden are fifteen miles south of the city of San Jose, Santa Clara County, California, in the Santa Cruz Mountains, at an elevation of 1,700 feet above the sea. These mines were first worked for quicksilver in 1845, but the operations were on a small scale, and no record exists earlier than 1850. They have been the most productive quicksilver mines in the world, excepting only the mine of Almaden, in Spain. They are developed to a depth of 2,300 feet, and the workings extend horizontally over an area one mile square.

From January 1, 1864, to December 31, 1891, the number of feet of drifting and sinking in the mines of the company, as shown by the records, amounted to 49·11 miles, at a cost of $2,191,831.95. This does not include the excavation made in extracting ore during the period named, nor any expenses for the same, while for the ground opened up during the previous period (from 1850 to 1864) 15 more miles of drifting and sinking can be added.

The reduction works consist of eight furnaces, include the most improved methods for working quicksilver ores, and may be considered as the most complete and perfect in every respect in the world.

The total product of all the mines on the company's



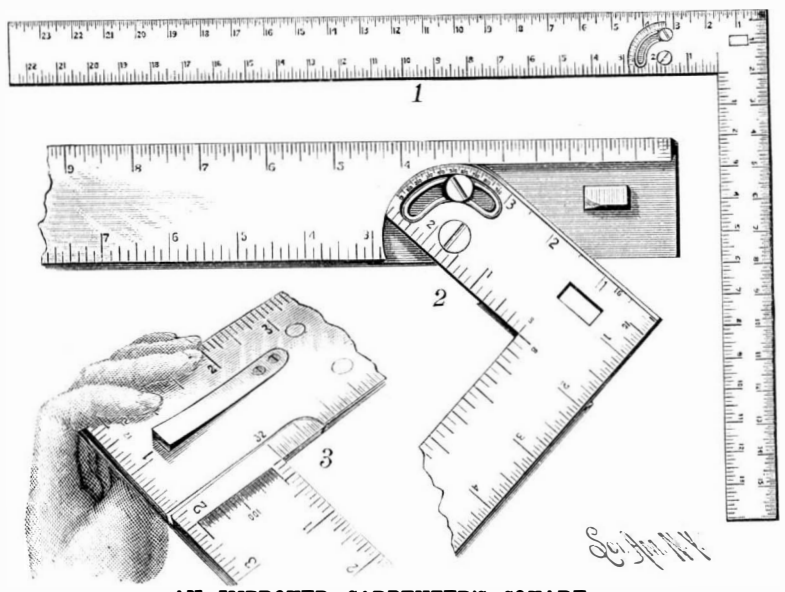
A BIRD'S EYE VIEW OF THE GREAT EXPOSITION.

property for thirty-eight years has been 924,659 flasks of 76½ lb. each, or 70,736,413½ lb.

The total earnings of the company for twenty-one years past have been about $15,000,000, and the total profits a little over $5,000,000.

AN IMPROVED CARPENTER'S SQUARE.

In this square the arms are pivotally secured together, so that one may be swung with relation to the other throughout an arc of ninety degrees, the joint between the two arms being such that there is a minimum of strain upon the pivotal point, and the bearing of such extent that there will be no liability of the parts wearing so as to be thrown out of a true perpendicular to each other when opened. The longer arm of the square has a shallow recess extending in for some distance from one end, the wall of the recess being undercut, and the recess terminating in a curve. In this recess is pivoted an angled extension of the shorter arm of the square, the curved portion being provided with graduated division marks up to ninety degrees, and between the pivotal screw and the curved end is a curved slot in which is a set screw, by means of which the two arms may be locked at any desired angle of adjustment. For automatically locking the two arms of the square in the ordinary position for use as a square, a flat bar spring is located in a shallow recess in one side, as shown in Fig. 3, a nose or latch on the free end of this spring projecting through in the path of the pivoted arm as shown in Fig. 2, so that when the latter is swung back it will be locked in the position represented in Fig. 1. It will be seen that this square can be readily folded to go in a regular tool box, and that by its use an angle or bevel can easily be measured or marked out with great exactness.



AN IMPROVED CARPENTER'S SQUARE.

For further information relative to this recently patented invention, address Mr. F. W. Palmer, agent, Station F, New York City.

THE DEDICATION CEREMONIES.

The ceremonies attending the dedication of the exposition buildings, October 11, 12, and 13, 1892, are to be very elaborate and impressive. The committee having the matter in hand will devote $300,000 to that purpose. It is expected that the President of the United States and his cabinet, many of the senators and congressmen and governors of the States, numerous representatives of foreign governments, and 10,000 militia and several thousand regulars will be present. A dedication ode and marches, written for the occasion, will be rendered with full choral and orchestral accompaniment. Patriotic and other music, a dedicatory oration, a pageant of symbolical floats representing the "Procession of the Centuries," and magnificent displays of fireworks will be among the chief features of the programme.

A grand dedication ball, probably in the Auditorium, on the night of October 13, 1892, will conclude the exercises dedicatory of the exposition buildings. Many representatives of foreign countries are expected to be present, and the event will be, to an extent, international in character.

A New Theory of the Origin of Petroleum.

An interesting compound of carbon with the metal barium, possessing the composition C_2Ba, is described, says *Nature*, by M. Maquenne in the current number of the *Comptes Rendus*. It may be considered, perhaps, as an acetylide of barium—that is, a compound formed by the replacement of the hydrogen of acetylene, C_2H_2, by metallic barium. For immediately it is brought in contact with water, pure acetylene gas is evolved with great rapidity. M. Maquenne has obtained the new substance by the direct action of metallic barium, employed in the form of an amalgam consisting of one part barium and four parts mercury, upon powdered retort charcoal. Upon distilling such a mixture in a current of hydrogen, when the mercury had been expelled and the temperature attained redness, an energetic reaction was found to occur between the barium and the carbon, with production of the new carbide or acetylide. The hydrogen took no part in the reaction, and M. Maquenne has subsequently found that it may be replaced by nitrogen; the latter, however, being less advantageous, inasmuch as the carbide produced is then admixed with more or less cyanide. The new substance, as obtained when hydrogen is employed to furnish the atmosphere, consists of a gray, friable mass, which remains quite unaltered when heated to bright redness. The moment, however, it is thrown into cold water it is decomposed, with a rapid effervescence of a gas which possesses the odor of acetylene, burns in the air with a luminous flame, precipitates a red substance resembling acetylide of copper from an ammoniacal solution of cuprous chloride, and, in short, possesses all the properties of acetylene. M. Maquenne adds that the acetylene thus obtained is remarkably pure. The reaction with water may be expressed by the equation—

$$C_2Ba + 2H_2O = C_2H_2 + Ba(OH)_2.$$

Barium acetylide would appear to be analogous to the compounds obtained by M. Berthelot by heating the metals of the alkalies in a current of acetylene, and also to the acetylide of calcium prepared by Wohler. The direct formation of this substance from barium and carbon, together with its reaction with water, afford another mode of synthesizing acetylene, which M. Maquenne considers to be of interest from the point of view of the formation of the natural hydrocarbons. He considers it probable that other metals possess this same property of forming acetylides under the influence of high temperatures. If, therefore, as M. Berthelot has attempted to show, it is a fact that acetylene forms the primary material, or starting point, for the formation of other hydrocarbons, it is quite possible that such compounds of metals with carbon, upon coming in contact with water under conditions of more or less pressure, may give rise to the production of the immense stores of natural hydrocarbons, such as those which exist in the petroleum wells of Russia and the New World.

© 1892 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING. — John P. Kirwan and James E. Kirwan, Jr., Pittsfield, Mass. This is a coupler of the knuckle type, the body portion of the pivoted knuckle having a downwardly inclined or beveled surface in combination with a coupling pin having at its lower end an inclined or beveled surface corresponding to that of the knuckle, whereby when the pin is raised the knuckle will be forced outward to the uncoupled position. The construction is very simple and durable, and the coupling pin is so formed that the knuckle will have more of a bearing on it than has been heretofore obtained, while it may be manipulated with the least possible risk to the operator.

METALLIC TIE. — Edward S. Moffat and Theodore G. Wolf, Scranton, Pa. The body portion of this tie is formed of a section of ordinary track rail, which is given an oblique bend in the middle and placed with its bottom flange uppermost. The end portions of the tie are re-enforced by short rail sections, with their flanges uppermost, the two parts being separated by space blocks opposite their web portions and firmly bolted together. The bearing heads thus formed for the track rails are provided with clips, held thereon by bolts, the clips being adapted to clasp the flanges of the track rails.

Electrical.

TELEGRAPH RELAY.—Charles M. Dyer, Cloverdale, Ind. According to this invention the armature in the relay is supported yieldingly on the front of a swinging armature lever, while a belt secured to the armature extends over a guide pulley to connect with the armature lever, the belt being arranged so that the movement of the armature will impart an opposite movement to the lever, the improvement providing a nicely balanced armature which will be held in proper adjustment without regard to the variations of the electric current.

Mining, Etc.

ORE WASHER.—Samuel C. McLanahan and William F. Kirk, Hollidaysburg, Pa. This is an improvement in that class of ore washers in which one or more shafts having radial blades revolve in a box or tank, the blades serving to agitate and carry the ore forward to the discharge. The stirrer shaft is formed with longitudinal sections of angle iron or steel, the radial flanges extended throughout their length, and the sections secured at their ends to cap plates. The blades or paddles are preferably formed of flat steel plates with twisted shanks connected with the flanges by bolts, the same bolts connecting the blades with the shaft sections and uniting such sections, while the arrangement of the bolt heads and nuts is such that they are but slightly acted on by the ore in the operation of the machine.

SAFETY KEEPER FOR MINING CARS. —Inkerman Bailey and Louis Feger, Madisonville, Ky. This is a device for locking a car upon the hoisting cage automatically, and releasing it at the top and bottom of the shaft. A shaft is mounted to rock on the platform of the cage, there being keeper arms on the ends of the shaft, and a pendent weighted rock arm adapted to rock the keepers into an upright position, a device in the mine shaft rocking the arm when the cage is lowered upon it. The improvement is for use on mine cages, whereby coal and other material mined is brought to the top of the shaft in cars, which are transferred from the hoisting cage to a surface track and moved to a point of discharge for their load, or are dumped directly from the cage.

SMELTING FURNACE.—Adam J. Schumacher, Butte City, Montana. This invention provides an improved discharge trough, readily applied, to automatically discharge and separate the products of fusion from the furnace, whereby the furnace may be run with greater continuity and less attention. The invention consists of a pipe formed into a trough and connected with a water supply to pass water through the pipe. The pipe is continuous, and bent so as to form the bottom, sides and ends, the bottom having an inlet opening, while one end is somewhat less in height than the sides, so as to form a discharge opening.

CAR DUMPING APPARATUS. — Maurice M. Neames, St. Patrick's, La. This invention relates to improvements in inclined railways and cars, providing means whereby cars may be drawn up such railways and automatically dumped at a certain point, being then placed in position to travel down the incline of its own accord. The construction is simple, durable, and inexpensive, and means are provided whereby the car may be quickly and conveniently loaded, and its contents readily delivered.

Mechanical Appliances.

SCREW CUTTING LATHE FEED MECHANISM.—Wendell P. Norton, Mount Vernon, N. Y. To conveniently and rapidly change the speed of the feed screw on screw-cutting engine lathes, according to the requirements of the screw to be cut, an improved feed is provided forming the subject of this patent. The shaft is driven from a series of interchangeable gear wheels, a pinion turning with and sliding on the shaft, and a driving gear wheel in mesh with the pinion, while a second series of gear wheels of various diameters is arranged step-like on the feed shaft and adapted to be engaged by the driving gear wheel.

BUSH HAMMER.—Clark Holden, Barre, Vt. This hammer is composed of oppositely arranged body plates having central bosses and transverse gibs fitted between the plates on the ends of the bosses, each gib having a tongue fitting into a longitudinal groove formed in the bosses, while bolts pass through the body plates and through the gibs to hold them in position. The construction is simple, and the blades are securely held in position, while the parts may be conveniently separated to take out the blades for sharpening or other purposes.

NUT LOCK.—Ira J. Griffin, Sing Sing, N. Y. Combined with a bolt having a longitudinal groove in one side, and a nut furnished with radial slots or recesses in its outer face, is a spring key fitted to the groove of the bolt and adapted to enter into the recesses of the nut. There is also a series of ratchet teeth in the bottom of the groove in the bolt, the key being adapted to engage the ratchet teeth. The device is very simple and effective, quickly locking the nut upon a bolt, with means for readily releasing the nut.

BEADING MACHINE.—James P. Howe, Cass City, Mich. The making of beads on eaves troughs and similar articles, the work being done accurately and rapidly, while the machine is easily operated, is the object of this invention, the machine being so constructed that it will not warp if made of wood and will not easily get out of repair. It consists of a fixed and a movable jaw hinged together and having registering grooves, a roller with a longitudinal groove being held to turn in the jaw grooves, while a block sliding along the outer side of the movable jaw has its outer face inclined, and a transverse bolt or bar extends from the fixed jaw into engagement with the inclined face.

CAN CAPPING AND CRIMPING MACHINE.—Mathias Jensen, Astoria, Oregon. This invention relates to former patented inventions of the same inventor, and provides an improved method of capping both ends of the can bodies with rapidity and certainty. This is accomplished principally by arranging two sets of jaws opposite each other, each adapted to close and form a tapered hole, the caps being conveyed one at a time to the narrow end of each hole, and the can bodies presented first one end through one of the holes into a cap and afterward the opposite end through the other hole into another cap, the can bodies following each other, so that the end of one can body is forced into one cap while the opposite end of another is at the same time forced into another cap, the capped cans being released to roll off one after another.

Agricultural.

CORN HARVESTER.—John N. Reimers and Wilhelm M. Schneskloth, Calumet, Iowa. This machine has infeed rolls provided with spiral flutes having their front sides inclined upward toward the rear, the rolls being geared to revolve toward each other on their under sides, and having their flutes inclined to diverge rearwardly to feed the stalks rearwardly without tending to crush them to the ground. Combined with the traveling harvester is a husker, having gathering devices for stripping the ears from the stalks, the husking devices having troughs pivoted at their upper ends to the main frame, and mechanism by which the opposite ends of the troughs may be adjusted vertically, as may be desired, according to the grade of the ground traversed by the machine, the troughs being provided with rolls adapted to tear the husks from the ears.

HOP PRESS. — Pierce Riggs, Crowley, Oregon. This is an improvement in that class of presses in which the follower operates horizontally within a press box similarly arranged. Combined with the press box and follower sliding in it are two sprocket wheels arranged one above the other, one of the wheels being keyed on the operating shaft, while a chain attached to the ends of the follower passes between the sprocket wheels, there being means for rotating the shaft. Another wheel is provided having a ratchet rim and a rim for receiving a rope, a lever and a pawl acting on the ratchet wheel to produce the initial and finishing movements of the plunger, the operation being practically continuous.

LAWN MOWER. — Edward Z. Kidd, Deadwood, South Dakota. To a plate rigidly connected to the front ends of the arms or handles, in front of the main axles, are secured forwardly projecting spear-shaped knives, and a plate fitted to slide transversely over this plate carries other V-shaped knives. The latter plate is attached to a lever pivoted on top of the axle, the rear end of the lever being pivotally connected by a pitman with a crank disk on a shaft whose forward end is rotated by a bevel gear in mesh with a bevel pinion operated from the main driving wheels. The power of the driving wheels is readily transmitted to the cutting mechanism, so that the grass is cut with great ease, and the sets of knives may be readily raised or lowered to cut long or short grass.

PRUNING IMPLEMENT. — Jesse M. Morgan, Chetopa, Kansas. This implement has a hook and a reciprocating knife, the shank of the hook having a longitudinal groove in which the back of the knife is fitted, and the hook proper having a slot through which the knife moves in the forward or cutting movement. The construction is such that the knife is guided and braced against being diverted by the resistance of the branch being severed, the knife also, when desired, making a shearing cut while itself having a straight path of movement.

Miscellaneous.

PNEUMATIC GRAIN CONVEYERS. — Frederic E. Duckham, Millwall Docks, London, England. This invention relates to a delivery apparatus for conveyers, for use in unloading or conveying grain, etc., between ships, barges, warehouses and granaries, by the carrying power of a current of air. The hopper-like chamber into which the suction pipe leads is provided with exhausting apparatus by which a partial vacuum is maintained, and beneath this chamber a twin receiver rocks upon a horizontal axis, the upper part of the receiver being curved to an arc to make a comparatively air-tight joint with the mouth of the hopper. The oscillating motion of the receiver is controlled by mechanism whereby a filled receiver is disconnected from the exhaust and falls over to discharge, bringing the other chamber into position to be filled. With this apparatus the grain is transported and deposited by the air current without the admission of sufficient air to destroy the necessary partial vacuum.

EVAPORATING PAN.—Jay B. Copeland, Punta Gorda, Honduras. This invention relates to an apparatus for purifying saccharine juices in the manufacture of sugars and sirup, the purifier consisting of a vessel divided by partitions into a series of longitudinal compartments ranging side, by side, the juice being partially heated in one compartment, highly heated in the next compartment, and so on, the temperature increasing until it finally escapes at the outlet. The scum is automatically removed, and the tendency to mix with the purified juice is overcome, the sediment being detained in the several compartments, to be removed as it accumulates, whereby the juice is brought to as clear and pure a condition as is possible without the first treatment with bone black, etc.

SUBMARINE BOAT. — John F. Auer, Nyack, N. Y. This boat has a tubular keel section with an opening in its bottom, and valved air supply and exhaust pipes, whereby the admission of water to the keel and its discharge are controlled by the air pressure in the keel section. The arrangement is such that the boat may be quickly submerged by compressed air and a water ballast, and raised directly to the surface through the medium of compressed air, the water ballast and the action of the air on it being so regulated that either the bow or the stern may be dipped or elevated at will. The storage of sufficient compressed air is provided for in the vessel to meet all emergencies, and entirely dispense with the use of pumps.

PIPE COUPLING.—William D. P. Aims, Jr., Philadelphia, Pa. This coupling comprises a case having a thickened end which is externally and internally screw-threaded, the exterior edge of the thickened end being beveled, a cap having its flange internally screw-threaded and with an aperture in its top and an annular space around the top, with an apertured packing. A simple form of coupling is thus provided, for use in connection with air, steam, water, or gas pipes, and one which is designed to make an absolutely tight joint.

SAMPLE CASE. — John E. Hitch, Wilmington, Ohio. This case comprises connected end pieces having interior shoulders, a flexible wall pivoted between the end pieces and adapted to be rolled upon the shoulders, supports on the interior of the wall, and catches to fasten the wall in a closed position, with a suitable handle. The case is especially adapted to exhibit auger bits, cutlery, jewelry, and various articles of hardware, holding the articles in a very small compass, and so arranged as to exhibit the goods to great advantage without the necessity of handling them.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

MARCH NUMBER.—(No. 77.)

TABLE OF CONTENTS.

1. Elegant plate in colors of a residence in the Queen Anne style of architecture, erected for F. S. Andrews, at Seaside Park, Bridgeport, Conn. Perspective view, floor plans, etc. Longstaff & Hurd architects, Bridgeport, Conn. Cost $7,000 complete.
2. Plate in colors of a cottage at Richmond, Mo. Perspective elevation and floor plans. Cost $1,500.
3. A residence at Cleveland, O. An admirable design. Floor plans and perspective elevation. Cost about $6,000.
4. A cottage at Gardner, Me., erected at a cost of $1,900. Perspectiveelevation and floor plans.
5. Floor plans and perspective view of a Colonial house at Portland, Me. Cost $3,800 complete.
6. Design for an ornamental chimney piece.
7. A cottage at Portland, Me. Cost $3,500 complete. Perspective and floor plans.
8. Floor plans and perspective view of a very attractive Queen Anne cottage erected at Babylon, L. I. Cost complete, $2,800.
9. View of the proposed Odd Fellows' Temple at Chicago. To be the most imposing structure of its kind in the United States, and the tallest building in the world. Height 556 feet.
10. Sketches of an English cottage.
11. An attractive residence recently erected at Belle Haven Park, Greenwich, Conn., at a cost of $11,000 complete. Floor plans and perspective elevation.
12. A residence at East Park, McKeesport, Pa. An attractive design. Plans and perspective. Cost about $4,000.
13. A cottage at Asbury Park, N. J. An excellent design. Cost $5,300 complete. Floor plans and perspective elevation.
14. Miscellaneous contents: Lawn planting; how to do it and what to avoid, with an illustration.—A suggestion for inventors. — Acoustics. — They bought burning houses.—Timber in damp places. —The taper of chimneys.—Stained cypress.—Low ceilings.—An improved woodworking machine, illustrated.—A fine machine for cabinet shops, illustrated. — Swezey's dumb waiter. — Graphic representation of strains. — An improved door hanger, illustrated.—A new woodworking machine, illustrated.—The baths of Diocletian.—The Stanley plumb and level, illustrated. — The Diamond Match Company.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., PUBLISHERS,
361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Wanted—50 second-hand screw-cutting lathes, 8 to 12" swing, either foot or steam power. Will pay cash. W. P. Davis, Rochester, N. Y.

"U. S." metal polish. Indianapolis. Samples free.

For pile driving engines. J. S. Mundy, Newark, N. J.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

6 Spindle Turret Drill Presses. A.D. Quint, Hartford, Ct.

Mixing machinery. J. H. Day & Co., Cincinnati, Ohio.

Universal and Centrifugal Grinding Machines. Pedrick & Ayer, Philadelphia, Pa.

Wanted—A water motor. W. F. A. Woodcock, Winona, Minn.

For first-class patterns write to Chas. Cassell, general patternmaker, Canton, Ohio.

Wanted—To buy first class patent. Iron article preferred. K. M. Scout, 2260 N. 17th St., Philadelphia.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps. Capacity, 100 to 40,000 gals. per minute. All sizes in stock. Irvin Van Wie, Syracuse, N.Y.

Crandall's patent packing for steam, water, and ammonia. See adv. next week. Crandall Packing Co., Palmyra, N. Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at Low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

What do you want to buy? We will send without cost to you, catalogues, price lists, and information concerning anything you wish. Paret, Willey & Co., 265 Broadway, New York.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

A middle aged married man, a traveled salesman of experience, now permanently located at Denver, Colo. (pop., 150,000), where he has extensive acquaintance, desires agency of some Eastern or foreign specialty. Address Brewster & Co., Mendota Block, Denver, Colo.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

INDEX OF NOTES AND QUERIES.

	No.
Borax, test for	4177
Carbon filament	4195
Cistern, lining for	4190
Cycloidotrope, tracings of a	4160
Electrodes, proportions of	4194
Electric light from weight power	4165
Fly wheel, weight of	4202
Glass, to chip	4183
Lamp bulbs, to color	4154
Typewriter ribbons, reinking	4199

(4152) G. F. writes: I made the eight light dynamo according to description of SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, except I made the yokes (bearings) of cast iron; has that any reducing effect on the dynamo? I made the armature core of ironwire. The dynamo started all right, but the magnet wire on armature becomes so hot as to melt the shellac varnish; what is the cause? I cannot light two carbons between brush and magnet (or *a* and *b* on cut); it only gives a large spark and a shock by holding carbons in bare hands by 25 to 30 ohms R. Is there no way to light a 16 candle power 50 volt light on that dynamo? How can I increase the current? I was careful in connecting the coils with the commutator. A. It was a mistake to make the yokes of cast iron as this short circuits the magnets, to some extent. In making anything from carefully prepared directions, you should not depart from the instruction given. However, your machine seems to work very well, and when you learn how to use it, you will doubtless find it quite satisfactory. By placing the carbons in contact in the circuit, you have practically short circuited the armature, thus causing too much current to pass through the armature. Place 15 to 20 ohms resistance in the circuit, then touch the carbons together, and instantly separate them one-sixteenth inch. You will then have the arc, and the machine will run easily. With the carbons long in contact, you are liable to burn out the armature. You should provide some means for separating the carbons one thirty-second or one-sixteenth inch and no more. By connecting from three to eight incandescent lamps in parallel you will have no difficulty in running them. You do not need an increased current. Learn how to use the current you have.

(4153) W. P. asks: 1. If the voltage of an induction coil can be reduced, and the amperage increased after it has been constructed, and how if it can be done? A. Only by using an inverted induction coil corresponding to the converter in the alternating system of electric lighting, the coil being worked by secondary

© 1892 SCIENTIFIC AMERICAN, INC.

current. 2. What is the voltage of and amperage of an eight light dynamo? A. 10 amperes at 50 volts E. M. F. 3. How much lead ought a vertical engine have that takes steam only on one end? The engine runs an exhaust fan. A. Only enough to take up the inertia of the piston and piston rod.

(4154) J. O. F. asks (1) how to color incandescent lamp bulbs a red, white, or blue color, also how to frost them, all by some chemical preparation. A. For permanent colors the bulbs are made from colored glass. To color them for temporary use dip them in thin collodion to which has been added aniline color. For frosting use vapor of hydrofluoric acid. See query 4142, taking care to protect all brass parts with vaseline or beeswax. 2. Can I light up a 6 candle power lamp for ten seconds at intervals of 3 to 5 minutes, with some form of dry battery without an excessive strain on the battery? How many cells approximate? A. Possibly 10 or 12 cells of one of the best forms of dry battery might answer.

(4155) E. H. C. asks: 1. A definition of the term "block system." A. A system of signaling on railroads. The road is divided into sections or blocks. At the beginning of each block is a signal post or station. When a train enters a block the danger signal is kept displayed until it leaves it. The system may be automatic and worked by pneumatic, hydranlic, and electric agency, or may be worked by operatives. 2. Whether telegraph stations at intervals along a railroad are essential to such a system? A. To some systems; not to the automatic. 3. Whether there is any automatic system in use whereby trains running on the same track may be kept a certain distance apart? A. The block system and the telegraph are used to keep trains at a proper distance. 4. Some receipt for the gilding of picture frames? A. For gilding receipts see "Encyclopedia of Receipts."

(4156) H. L. B. says: I saw some time ago in the SCIENTIFIC AMERICAN a description, and I think an advertisement, of what is known as a "mineral rod" for locating gold, silver, and other metals, buried in the ground. While I am writing to you let me ask for a solution of something that has puzzled me for some time. Parties around here report having seen, at night, a ball of fire suspended in air about four feet from the ground, with flame going down to about one foot from the ground and returning to the ball, which is stationary. I have not been able to see it as yet, or I would investigate. Will you please tell me what it is and the cause of its being in one particular spot. A. There is no known device for locating any minerals or ores, except iron, which is indicated by the magnetic needle when in large quantity. We think such a device may have been described as the work of a crank. What you describe seems to be the "Will-o'-the-Wisp," or "Jack-a-Lantern." What it is due to is uncertain. It has been attributed to spontaneously inflammable phosphureted hydrogen, and also to marsh gas. The latter not being spontaneously inflammable leaves the question of ignition unanswered.

(4157) L. N. D. asks for the best way to work with oil painting on white silk and satin. A. Partly remove the oil from the paint by spreading it on a cloth or a piece of blotting paper, then thin it slightly with turpentine.

(4158) J. E. H. asks: What metals are of more money value than gold? A. Caesium, calcium, barium, cerium, didymium, gallium, indium, iridium lanthanium, lithium, niobium, palladium, rhodium, ruthemium, strontium, terbium, titanium, uranium, yttrium, zirconium.

(4159) O. O. E. says: From a spring 110 rods distant and 40 ft. fall, few bends, what size pipe would I have to lay down to get four horse power from the motors that are made for such purpose? For two horse power? A. You will require a 6 inch pipe, supplying 66 cubic feet of water per minute, 4½ inch pipe for two horse power, 33 cubic feet per minute. You should know the flow from the spring for the power that it will produce. A 3 foot diameter motor will give you four horse power and a 24 inch motor Pelton style will give you two horse power with the quantities of flow as above stated.

(4160) G. H. C. writes: I made myself a cycloidotrope not long since, which draws elegant figures on smoked glass. Can you tell me how to transfer them to paper? A. Coat the glass with collodion made granular by the addition of water and stained orange with aniline. Make the tracings on the collodion surface, or you can print the smoke tracings by means of a camera after the manner of lantern slides. Then print on sensitized paper, using the tracing as a negative.

(4161) W. A. V. says: I have been taught from scientific books that motion can be produced from heat, and that heat can also be produced from motion. Now I cannot see how heat can be obtained from motion, other than mere friction. But this is not the heat that I want. I want useful heat, heat that will heat my house and cook my food. Now I would like to know how any scientist can obtain this kind of heat from the motion of a water wheel. Here we have motion without cost of coal; but I cannot see how heat is to be obtained from it. Can the SCIENTIFIC AMERICAN enlighten me on the subject? A. We are as much in the dark as yourself in regard to cheap heat for domestic use. The abstract notions, as you state, are all right, but as yet we do not see the way clear to realize on the faint gleanings of scientific research. When coal gives out, future generations will find ample room for economy in utilizing the ways and means of living according to the new conditions, or in the most primitive ways of the early ages. Mechanical energy can be transformed into heat energy by electricity.

(4162) O. A. C., Monte Vista, Col., says: 1. A day or two since I witnessed something quite unusual, I think. Time, 7:30 A. M.; mercury 10° above 0 F.; rising sun obscured by clouds, but shining on the mountains, northwest. Upon looking in that direction (northwest) a mirage was seen, together with what is commonly called "heat waves," and quite distinct or pronounced. Both mirage and heat waves seemed to be traveling west, and soon disappeared. A. There seems to have been considerable disturbance in the atmosphere in Nebraska and Colorado on the 17th of February, causing halos and sun dogs in Nebraska and mirage in Colorado. We will be glad to hear from other observers of these phenomena on that day. 2. Does the rotation of the earth upon its axis influence materially either the tides, marine currents, or direction or velocity of the winds? A. The attraction of the moon principally and of the sun slightly are the forces that produce tidal action. The motion of the earth gives rise to marine currents and intensifies tidal flow. The unequal distribution of the heat of the sun, together with the motion of the earth on its axis, gives direction and velocity to the winds.

(4163) J. F. M. W. says: I am building a triple-expansion engine, size 3½ in. by 5½ in., and 9 in. by 6 in. stroke; boiler pressure, 80 lb.; 200 revolutions. What size surface condenser, and also what size air pump, will I require? A. Surface condenser, 12 square feet surface; air pump, one-fifth area of high pressure cylinder, or 2 in. by 6 in. stroke if single acting and direct connection, or 1⅛ in. diameter by 6 in. stroke if double acting.

(4164) C. B. S. writes: 1. I have constructed the "simple electric motor" described in SUPPLEMENT, No. 641, winding armature and fields with No. 18 wire, and would like to run it by storage batteries, charging them on a 50 volt incandescent light circuit. How many and what size cells should be used, and how long would they run the motor when fully charged? A. You will require four cells, with 17 plates 6 by 8 inches. 2. Is the way of covering storage battery plates with red lead, as described by C. L. Woolley in SCIENTIFIC AMERICAN of November 28, 1891, a good method? A. Yes. 3. How many gravity cells would be required to charge the storage battery, and how long would it take? A. Four to each cell of storage battery. The time required is 6 to 8 hours. 4. Would the motor run a 9 in. engine lathe or a small planer? A. It is too small. You will probably require one-half horse power. 5. In charging the battery on the incandescent light circuit, should resistance be put in the circuit? A. Yes. 6. How many amperes can be safely carried through Nos. 22, 24, 28, 30, and 36 copper wire? A. 1·08, 0·65, 0·25, 0·16 respectively.

(4165) W. M. C. asks: Can an electric light plant large enough to light five 20 candle power incandescent lamps at one time be operated by a weight power, practically speaking? Said power to run four hours without attention. If so, about how much labor would be necessary to wind it up? A. It is impracticable to accomplish what you propose. One horse power requires the fall of 33,000 pounds through the distance of 1 foot each minute, so that this weight would have to fall 240 feet in four hours—twice the weight half the distance, or half the weight twice the distance. It would take a 1 horse power steam engine something over four hours to wind it. A 2 horse power engine could do it in about two hours. A 4 horse power engine in about one hour. One man could wind it in about four days of ten hours each, but it would be constant and severe labor.

(4166) W. E. H. asks whether electricity has been applied with success to safety bicycles? A. It has not.

(4167) C. R. W. asks: What power prevents the bottom course of brick in our large structures from crushing with the tremendous weight above it? Please give me as explanatory reply as possible. What accepted theory is there as cause for the wind blowing? A. The resistance or crushing strength of brick and other building material is far greater than the weight of the superstructure. Architects and engineers understand this, and spread the foundation to meet the pressure from high buildings. A single common red brick, when properly laid in strong cement, is equal to a load of 12 tons, and it will require a column of cement-laid brick nearly 10,000 feet high to crush the bottom course. The heat of the sun and the rotation of the earth are the primary causes of the circulation of the atmosphere. See query 4162.

(4168) W. L. U. asks: 1. What is supposed to be the cause of aurora borealis, which is seen in the northern heavens? A. The aurora is a display of electricity in the upper atmosphere, and is supposed to be largely developed by disturbances in the sun. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 372, for theories and description—an interesting paper. 2. Why does the rainbow always appear in a semicircle? Why not appear in the whole eastern or western heavens, according to the time of the day, instead of in a semicircle, as it always appears? A. Rainbows derive their light from the sun as a radiant. The conditions of the reflection and refraction of the sunlight from rain drops require a circle or part of a circle to meet the radiant points of the sun and the eye of the observer. 3. Is there a limited sum which can be paid in copper or nickel currency? If so, what is the highest sum which can be so paid legally? A. Silver coin is a legal tender to the amount of ten dollars at any one payment. Nickel and copper coins are a legal tender to the amount of 25 cents at any one payment.

(4169) G. W. F. S. asks: What provision can be made for properly carrying off water emanating from a cellar, when the cellar is below point of sewage plant? A. Water cannot be lifted without power. The location and facilities for obtaining it you have not stated, so that in a general way we can say, if you have gas, a small gas engine and pump is recommended. If not, a petroleum or gasolene engine and pump, such as is advertised in our columns, is in order. If you have facilities for accommodating a small windmill away from the house, with a suction pipe leading to a deep cespool in the cellar and discharging into the drainage system, you will find it as inexpensive and easily managed as any device that we can name.

(4170) W. L. M. says: I am building a house, and to secure ventilation intend to place ventilating registers in the sides of the walls, the open space between the partition studs being used as a ventilating shaft. Above the attic floor a tube will connect with this shaft and be run either into the chimney flue or out under the eaves of the roof. Now the questions I want answered are these: 1st. Should the ventilators be placed near the floor or near the ceiling? 2d. Will the hot foul air ascend this shaft? 3d. Would it be better to run the tube connecting with the air shaft into the chimney flue or out under the eaves of the house? A. For the best arrangement of ventilators in the rooms there should be one at the bottom and one at the top for each room. If you choose to use but one, place it at the top in rooms that have a fireplace and at the bottom in rooms that have no fireplace. Under no consideration should the ventilation be connected with the chimney, for there are times when the rooms will be filled with smoke from back draught, besides the danger from fire. The ventilator shaft should rise through the roof, with a draught hood on top. Opening the ventilator under the eaves is not good practice. The pressure on the windward side will make a strong down-draught in windy weather.

(4171) R. M. says: In looking at an imaginary object created by a mirage, would a telescope or a pair of field glasses reveal the deception, or would the deception still seem perfect? A. We have no experience with a telescopic view of a mirage, but should judge that as the telescope is only a larger eye, the effect would be the same; but the field of vision being so small in the telescope, the scope of a mirage, due to the larger field of the eye, would be lost in the telescope.

(4172) H. V. K. asks: 1. I have attempted to make a Leclanche cell: filled porous cup with broken bits of electric light carbon, about one large piece of regular battery carbon. Filled in with MnO_2. Set cup in strong solution of NH_3Cl, in which was bar of zinc. After settling for hours current is not strong enough to ring a bell. What is the matter? A. You should use the best quality of graphite, and manganese binoxide with the dust sifted out. 2. Has trinitrate of bismuth (art. on p. 87, February 6, 1892) another name? Large wholesale drug house in city claim no knowledge of it. Where can I get it? A. It is the neutral bismuth nitrate, and any reputable drug house should supply it. 3. Is stannous chloride and stannic chloride the same? A. No. The first is $SnCl_2$, a solid, the second is $SnCl_4$, a liquid. 4. Has the "Scientific American Cyclopedia" a department on electrics? A. Electrometallurgy is treated in it. For general electrical topics see our SUPPLEMENT catalogue or Hopkins' "Experimental Science," $4 by mail. 5. Tell me where I can buy an autophone. A. Address any of our advertisers who deal in scientific apparatus, such as Queen & Co., Philadelphia, Pa. 6. What is a concentrated solution of borax, and how can you get shellac to mix with it? A. Heat the water with excess of borax and then pour off and heat with powdered shellac. 7. What is meant by the brush circuit and field circuit from a dynamo? A. The brush circuit should mean all the circuits taken from the brushes; the field circuit is the circuit which excites the field magnets.

(4173) J. W. C. asks: 1. Given a hollow air-tight body which with the superadded weight of one ton will be exactly submerged in water, what additional weight will be required to sink it thirty feet below the surface of the water? A. The compressibility of water is 0·00004663 of its own bulk at 15 lb. pressure, so that if your apparatus displaces one ton water, then 0·0004663 × 2,000 pounds = 0·09326 of a pound to sink it 34 feet after it is under water. This will also be somewhat modified by the elasticity of the hollow vessel, which is also subject to compression, and if it has as much or more compressibility than water under the increasing pressure of depth, it will go to the bottom without additional weight.

(4174) D. R. F. asks: 1. Please inform me whether glass cells would not answer the same purpose or be superior to gutta percha cells in the construction of the large (8 cell) plunge battery described in "Experimental Science"? A. A glass cell is preferable to a gutta percha cell on many accounts. 2. Also kindly state how many cells would be required to run eight incandescent lights? A. It depends something upon the voltage of the lights. Six cells will run two or three 10 volt lamps. 3. Would the current from such a battery be as steady and the light as bright as from a dynamo? A. Yes.

(4175) T. H. B. asks: Will a wrought iron collar shrink in heating? To explain: Suppose I turn a collar large enough to just slip over an inch bar when it is cold, will it by heating make it tight on the shaft? (After it is cold.) Does a bullet have the same velocity on returning to ground as it had when it left the barrel of the rifle? Supposing it to be shot up vertically. A. Wrought iron rings will become slightly smaller by heating and cooling, so that if made just to fit a mandrel, it will stick if put on hot and cooled. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 830, "Gun Wrinkles," for answers to various questions in relation to bullets and shooting.

(4176) A. asks: 1. Will the dynamo described in SUPPLEMENT, No. 161, light an incandescent lamp? If not, why? What changes would have to be made? A. The dynamo referred to will light two 5 candle power lamps. 2. Would motor described in SUPPLEMENT, No. 641, run the dynamo? A. It is hardly sufficient for running the dynamo up to its full capacity. 3. Can dynamo described in SUPPLEMENT, No. 161, be used as a motor? A. Yes. 4. Could number 18 or 20 wire be used for the armature instead of 16? What difference would it make in motor? A. Yes, it would give a higher electromotive force, but it will be necessary to modify the field magnet correspondingly.

(4177) "Andes" asks: What is the most simple method of testing the existence of borax when exploring alone on horseback, and therefore unaccompanied by baggage? A. Pulverize the mineral, moisten with sulphuric acid and cover with alcohol and ignite. A green flame will show the presence of boracic acid provided other substances (barium or copper) are not present. If present, separate by well known processes. A good test is to moisten the mineral with sulphuric acid and glycerine and ignite on a platinum wire in an alcohol lamp or blowpipe flame. A green flame goes to prove boracic acid. A good corroborative test is to dissolve the mineral, first pressing with sodium carbonate if necessary, then to slightly acidify with hydrochloric acid, to dip a piece of turmeric paper in it and dry the paper at a low heat. A brownish red color shows boracic acid. This test is also interfered with, but the two are pretty good proof. See Cornwall's "Blowpipe Analysis and Determinative Mineralogy," $2.50 by mail. Study and experience are required to prepare for field work in mineralogy.

(4178) J. W. P. asks: Can you tell me of any acid or liquid that will eat or burn up tinfoil (sample inclosed) in the same way that brass door-plates are protected in parts by wax and then the rest etched with acid? A. For etching tin use a mixture of 1 part nitric and 2 parts hydrochloric acid and 3 parts water; 1 part potassium bichromate may be added. All parts are by weight.

(4179) P. H. asks: How much storage battery should I require for say 20 lights, not over half of them being used most of the time, so as not to have to recharge the battery oftener than once in two or three months? A. It is impracticable to retain the charge in storage batteries for two or three months as you suggest. The batteries will have to be recharged once every ten days or two weeks. To light 20 lamps you will require 26 cells, provided the lamps are 50 volt lamps.

(4180) A. B. asks: 1. I made a condenser for the induction coil shown in SUPPLEMENT, No. 161, and same would not work satisfactory. I attached same to the primary wires, and the vibrator works all right, but the coil will not give any spark when the condenser is attached. In making the condenser I used 12 sheets of tin foil 5 inches by 5 inches and connected them at each end 1, 3, 5 = 2, 4, 6, etc., and separated each sheet by well shellacked paper. A. You will probably find that there is a cross connection or leakage in your condenser. 2. I have two glass cells 6 by 8 by 9, and each cell has two zincs and three carbons, 6 by 8 inches by ¼. What is the amperage of the two connected in series? (Plunge cells.) How can I compute the capacity of a plunge cell with reference to the square inch of plates? A. The amperage of a battery is computed by dividing its E.M.F. by its resistance.

(4181) S. M. I. writes: 1. I want to heat a German silver wire about 12 inches or 15 inches in length up to as high a temperature as it will stand with an electric current of 8 amperes with E.M.F. of 50 to 60 volts. What number of wire should I use? A. With above E.M.F., and using such current, you could heat about 14 feet of No. 19 German silver wire to 1,500° F. The amperes fix absolutely the diameter of the wire; the relation of amperes to volts fixes its resistance, *i. e.*, its length; hence the calculation cannot be carried out for the incompatible conditions of length given by you. 2. Why on standing close to an incandescent electric lamp do the filaments appear as fine threads of white light, and on receding from the lamp they seem thicker until they appear as a single flame? A. The phenomenon is known as irradiation.

(4182) G. T. L. asks: What is the process of making the smalt or rough, sand-covered signs? What means are used to prevent the oil in paint, when lettering on cloth, from spreading around the margins of the letters and turning to a dark color? A. The ground is painted the same color as the smalts. The smalts are then thrown on in the same way as sanding paint. The figures or letters are painted on the cloth with a thin mucilage of gum tragacanth and the color laid on so as not to overlap.

(4183) A. F. O. writes: I have somewhere heard of a process for roughening the surface of glass by applying something strongly adhesive, which, by subsequent drying and contraction, tore off the surface of the glass in thin flakes. Can you give me the particulars of the process? A. Make a thick solution of gelatine, pour it on the glass, let dry on a level. In shrinking, the gelatine will take out the surface of the glass.

(4184) A. W. says: 1. I wish to know what number of wire should be used on a magnet to draw the armature with the greatest force and how much wire, using three cells of Fuller battery. A. For your magnet use soft iron cores ⅝ of an inch in diameter, and upon them wind 140 feet of No. 20 magnet wire. 2. If the balance or fly wheel on a buzz saw or other fast running machinery were inclosed in a vacuum and the air kept out by a small pump operated from the main shaft, would there not be a considerable saving of power? It seems to me the speed would be more easily attained and a great deal harder to check. What are your views on the subject? A. It is doubtful if the plan suggested would effect any saving, as considerable power will be required to maintain a vacuum. You could, however, save something by inclosing the wheel in a practically air tight box. By this means the air would be prevented from being thrown off by centrifugal action. 3. Can you give me the formula for a composition that is a non-conductor of electricity, light in weight and will not warp by being put for hours in a liquid heated to 80° Fah.? A. We know of nothing better for your purpose than glass or porcelain.

(4185) W. E. B. asks: 1. Would you advise a person, wishing to purchase a first class watch, to purchase a non-magnetic watch, or is the ordinary watch as good as a non-magnetic one? A. If you are liable to visit places in which your watch would be subjected to magnetism, we should certainly advise the purchase of a non-magnetic watch, as the poorest watch of this kind will keep better time than any magnetizable watch when magnetized. 2. Where is the most desirable non-magnetic watch made, and by what company. Some jewelers tell me that the non-magnetic watch is a fraud; while others say the time is coming when a non-magnetic watch will be necessary if a person wants a reliable watch. A. There are several non-magnetic watches in the market, which are about equally good. We think that jewelers generally believe it to be impossible to make an absolutely perfect timepiece on the non-magnetic principle, but they are sufficiently accurate for all ordinary uses.

(4186) C. M. P. asks: 1. Is the simple motor, described in "Experimental Science," self-regulating? In other words: You say it is ⅙ horse power,

© 1892 SCIENTIFIC AMERICAN, INC.

Now, could I take half the battery required to run it at its fullest capacity, and run it as a one-sixteenth horse power machine? A. The motor would require more than one half the battery to run at one-half its full capacity. 2. Where the instructions are to use wood, would it be any better were I to use type or babbitt metal? A. Type metal or babbitt would not do for the core for the hub of the armature, unless you provide a commutator cylinder separate from the hub. 3. Please let me know what is meant by the word shunt as applied to electrical machines. A. Shunt is a term applied to one part of a divided circuit.

(4187) E. D. H. asks: 1. Please give the solution of the Leclanche batteries. A. Saturated solution of sal ammoniac and water. 2. What size storage battery would be required to run a small motor for operating a wood turning lathe? A. Your query is too indefinite to admit of direct reply. It requires 8 cells of storage battery per horse power. 3. About what it costs and how much would the cost be in renewing it? A. The cost of a storage battery is $15 per cell. The cost of charging, of course, varies with the cost of the motive power used in driving the charging dynamo. Probably a fair average will be ten cents per cell.

(4188) M. W. writes: Suppose two electrical storage batteries each having capacity enough to run a dynamo for several hours of several horse power, the one being charged and the other not. How long a time will it require after they are connected till there is an equilibrium between the two, that is, will the charges in the two become equal in an instant or will it require some time? A. The charging of storage batteries by means of other storage batteries is practically the same as charging them by the current from a dynamo, and they should be charged at the same rate. For elaborate tables on charging and discharging dynamos consult SUPPLEMENT, No. 838.

(4189) H. R. writes: I am making some blue enamel for enameling iron ware made of sand, borax, potash, and cobalt oxide. When ground into a pulp, there is a white scum on the top of the enamel. Can you let me know the cause of it? Can you give me a receipt for blue enamel? Is there any book published on the manufacturing of glass and enameling? A. Fuse the mixture, pour while fused into water and regrind it. This will give it greater uniformity and avoid the scum. The "Scientific American Cyclopedia of Receipts," $5 by mail, gives a great deal of information on this subject.

(4190) W. P. D. writes: During last fall's drought we dug a cistern, at a depth of ten feet found moisture. It was walled up with brick and cement and bottom laid with same. (Star brand cement being used.) Later on, when the ground became thoroughly wet, a leak showed in bottom, and water rose two feet deep. It was pumped out and another layer of brick and cement was put down, making the bottom double, but it filled with water just the same. What had we best do to secure good results and make it hold full up? Would the water go out during drought as it came in? It is now half to three-fourths full. All comes through the bottom. A. The water will doubtless disappear in the dry season. The remedy will be to pump out the cistern, plaster walls and bottom with best Portland cement, neat, then put in another bottom and walls of brick laid up in the cement.

(4191) R. M. asks: 1. Please give chemical action in a single fluid battery using iron for the positive plate, and a saturated solution of common salt. A. The iron would oxidize very slightly and the battery would become polarized. The salt would merely act to accelerate oxidation. 2. Also E. M. F. of the same. A. It would be very slight; practically only a fraction of a volt.

(4192) E. L. writes: I have a silver wash made by dissolving silver chloride in a solution of hyposulphite of soda. When first made the solution worked very well and deposited silver nicely. Now, after a lapse of several months, it will not work at all, and there is a considerable amount of black sediment in it. Can you tell me how it can be made to work, or how the silver can be reclaimed, if that is impossible? A. Possibly your solution is exhausted. To get rid of black sediment, filter. To recover silver add a few pieces of zinc, acidify in open air with sulphuric acid, and eventually dissolve all the zinc. The silver will be left in the metallic state.

(4193) G. H. C. asks: If the rings used in the armature of motor No. 641 were so made that a segment of iron came between each pair of coils so that the circumference were unbroken, would it decrease or increase the power of the motor, and are such rings made? A. It would increase the power of the motor to some extent.

(4194) W. T. B. asks: 1. If the carbon sticks used for arc lamps be used for carbon element in bichromate plunge battery, should enough sticks be used to make the carbon surface equal the zinc surface? A. You should use enough of the carbon rods to make the carbon surface nearly or quite double that of the zinc surface. 2. How many half gallon gravity battery cells are required to run motor described in No. 761, SUPPLEMENT? A. The gravity battery is not suitable for running motors of this kind. You will probably require 20 or 30 cells to run the motor up to its full capacity. Better use a plunging battery or a Bunsen. 3. Would not said motor be just as efficient, if a circular iron band, say ¾ inch wide, ⅛ or three-sixteenths inch thick, fastened to a wooden disk, were substituted for the iron disk to which the armature spools are attached, the spool cores to pass through the wood disk and be screwed to the iron band? A. There is no objection to the construction you describe.

(4195) E. H. asks: What is meant by a silicated carbon filter? What is its composition, how made, and what is its action, or, in other words, how does it purify water, etc.? A. Silicated carbon filters may be any mixture containing silica and carbon. This may be sand and charcoal mixed or a porous sandstone slab covered with pulverized charcoal. Solid filter slabs may also be made from pulverized retort carbon, sand, and clay, by baking the same as bricks are made. The action is principally as a filter or strainer, with a slight tendency to deodorize the water by the absorptive action of the carbon.

(4196) W. E. K. says: Will you please tell me what is meant by latent heat, and also something to take away warts? A. Latent heat is the heat that has been absorbed and which becomes hidden in the change of fluids to vapor, or in the fusion of solids. It is also the heat that is derived from the condensation of vapors and from fluids when passing into the solid state. As its name indicates, it is hidden or concealed heat, not shown by change of temperature. Try a drop of kerosene oil on the warts twice a day.

(4197) J. H. K. asks: 1. How are school blackboards made? A. The best mixtures contain a vehicle, often shellac varnish, with emery or ground pumice to give "tooth," and lampblack or other pigments, often with a little Prussian blue. See the "Scientific American Cyclopedia," $5 by mail. 2. How can gas be lit by electricity and what is a simple way? A. By a spark coil, three or four Leclanche batteries in circuit therewith, and a circuit-breaking attachment to each burner. The latter are sold by electrical dealers. 3. How can small bombs be made, which, when thrown to the ground, do not make much of a report? A. Fulminate of mercury is the explosive of ordinary torpedoes. All this class of manipulation is very dangerous.

(4198) F. W. P. asks: Can a fish of any kind or eel shoot or swim up a ten-foot dam or falls? Does the bottom of a wagon wheel go slower than the top? Is it better to write a letter for information to the publishers of any paper, or send an article before doing so? A. Salmon are known to jump a considerable fall with deep water below. They jump all the falls of the Columbia below Spokane. We have no figures. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 275, for an interesting account. Eels crawl around falls or dams. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 706, for a discussion of the wagon wheel question. Send letters and article together.

(4199) C. C. B. writes: Will you allow me to add a little to your directions for reinking type writer ribbons. I find that one part each of alcohol and glycerine, with aniline dye, makes the ribbon too sobby, and causes it to blur in use. After using one of my ribbons for a day or two inked as above, I ventured to run a hot iron over it, having first put it between two blotters. This remedied the trouble at once.

(4200) W. D. R. says: I wish to convey water through a pipe 260 feet from a ditch. I have 24 feet fall. I would like to know what is the smallest size pipe I can use and have a supply of 3 gallons per minute. A. A ¾ inch pipe will give you about 5 gallons per minute. We do not recommend smaller pipe, on account of its liability to close after being in use some time.

(4201) H. G. G. asks: What occupies the space in the top of the barometer tube? Is it a a vacuum? If it is not a complete vacuum, what fills the space? A. It is as near a perfect vacuum as possible. In a barometer that has no spot at the top when it is tipped down so that the mercury touches the top of the tube, there is good proof that it contains no air or gases. There is only a possibility that an infinitely small amount of vapor of mercury rises in the open space that condenses as the mercury rises to the top in tipping the barometer.

(4202) W. S. T. says: Please give me the proper weight for a flywheel for an engine 3½ inch bore, 6 inches stroke, running 90 revolutions, cutting off ⅛ stroke, or give rule in next issue for finding weight of flywheels. A. For weight of flywheel rim

$$\frac{\text{mean piston pressure} \times \text{stroke in feet}}{\text{Rev. per m.}^2 \times \cdot 0003}$$

or for your engine, assuming 40 pounds mean piston pressure per square inch,

$$\frac{40 \times 8{\cdot}29 \times \frac{1}{16}}{90 \times 90 \times \cdot 0003} = 34{\cdot}6 \text{ pounds.}$$

(4203) H. M. asks: What is the red transparent composition used on the outside surface of corrugated lenses for semaphore signal lamps and how is it made to adhere to the glass? From close observance I notice that green and blue lenses are not made in this way, but apparently the coloring matter, whatever it may be, seems to have been mixed through the glass. From this the question arises, can green or blue lenses be made in the same manner as the red? A. Colored glaze is used and baked on as with glazed earthenware. Otherwise the coloring is made at the glass house by using colored glass in blowing. Colored varnishes may be used for cheap work. The principal colors in sheet glass are sold by the trade, consisting of ordinary glass glazed on one side with colored glass. This is a special business for ornamental windows and decorated work.

(4204) W. B. says: Suppose there is a hole through the center of the earth from one side to the other. The air being exhausted in the hole, a lead ball is dropped in; will it fall past the center? Will its velocity increase or diminish in the first 2,000 miles? A. The lead ball would not drop through the hole freely unless the hole was from pole to pole. The motion of the earth decreases from the surface toward the center or axis. The ball partaking of the surface velocity would hug the east side of the hole, because it would always be approaching a part having a slower motion as it moved toward the center. With a polar hole the ball would drop with an increasing velocity to the center, and pass to an equal distance to the other side with a decreasing velocity, from the effect of gravity, and would vibrate from surface to surface, no friction being considered.

(4205) C. P. M. asks: If a cannon be fired at a horizontal and another ball be dropped from the same height at the same instant, which will reach the ground first? I say there will be no difference. A says that is an old theory, and that modern science has proved that the ball that is dropped will reach the ground first, and if the SCIENTIFIC AMERICAN does not agree with him he will not accept it as authority. Will the best modern rifle fired at 100 yards throw a ball in a straight line that or any part of that distance? If not, how far above the target will the rifle actually be sighted, and at what point along the line will the ball be farthest above a direct line, and how far? A says he has sighted rifles as a business, and that a rifle will throw a ball in a straight line for a given distance varying according to the velocity. What is your opinion of A? A. You are right as to the time of direct fall and the fall of the horizontal shot. A ball fired horizontally does not move in a straight line after it leaves the gun. It is a downward curve. The sighting is depressed from the line of the bore to meet the curve of the ball at given distances. Hence the ball rises on the line of sight, but not on the line of the bore. Do not think well of A's opinion. The depression in sighting depends upon strength of powder and weight of ball, as well as length of barrel or distance between the sights. We have not the figures used in practice.

(4206) W. E. MacK. writes: 1. I made an induction coil as described in your paper, but can only get about a one-half inch spark. There are two pounds of secondary wire wound perfectly, each layer shellacked, with two layers of thin paper between each layer. I feel positive that the insulation is perfect throughout. The condenser is made from leaves of an old ledger, every leaf examined for imperfections and then dipped in paraffine. How can I test to find out where the trouble is? A. Test the secondary wire of your induction coil by means of a galvanometer and rheostat, and see if it has the resistance due to its length. If the resistance of the coil is less than that of the wire, your insulation is deficient at some points. If the resistance is extremely high, or if the current will not pass at all, it indicates a break. Possibly you are not using sufficient battery to develop the full power of the coil. If you are using small cells, try connecting them up by twos in parallel. 2. Why is it that if the wire from the zinc of a bichromate of potash cell be connected directly with the carbon it becomes red hot, while if connected at the binding post or to another piece of wire from the carbon it is not made even sensibly warm? A. By connecting the wire directly with the binding posts, you have the greatest possible current you can obtain from the battery. Any additional resistance introduced into the circuit reduces the current. 3. I have three cells of carbon and zinc battery which I charge with a saturated solution of bichromate of soda and one part sulphuric acid to five of solution. Why is it that when this battery is set up fresh it becomes so hot that the paraffine is melted from ends of the carbons, although everything is quite cold before the zinc is put in? A. The fact of the zincs becoming warm in your battery indicates poor amalgamation. You should amalgamate your zincs thoroughly in every part. 4. On page 321 of Mr. Hopkins' book he speaks of sulphurous acid water. What does he mean? A. Sulphurous acid water is water in which sulphurous acid (which is a gas at ordinary temperatures) has been absorbed. 5. How shall I go to work to harden a steel roller (tool steel) 4 inches by 2 inches diameter with journals 3 inches by 1½ projecting from each end? I wish the journals soft and the center as hard as possible to get it. I have made three, but all crack in the hardening? A. For your roller take steel that has been worked as little as possible, and never heated above a low cherry red. Heat the roll to a temperature required for hardening and dip it straight down into cool water, holding it there until it becomes cool; afterward draw the temper of the journals. A roll of this kind is almost sure to spring in hardening. It should be finished, after hardening, in a grinding lathe.

Marlboro asks: For a variety of whitewash receipts.—J. G. S. says: What is a good formula for a floor stain? How made and applied?—F. H. E. says: Is there any way in which short hair may be curled without the use of curling iron, and without doing any injury to either hair or scalp?—E. W. says: Please give me a cement to fasten glass and brass or glass and tin, so that it can stand hot water?—H. W. F. says: Will you give receipt for Worcestershire sauce, same as made by Lea & Perrins?—R. C. C. says: Please give formula for rubber mixture to repair rubber coat.—A. H. R. says: Can you inform us of some lacquer to use on brass signs to keep them from tarnishing?—R. F. M. says: Could you kindly give us a recipe for hard transparent cement for sticking glass, insoluble in water?—H. B. A. says: How can I remove mud stains from a sole leather dress suit case without leaving any mark? Is there any way to remove initials badly put on with the black paint generally used for that purpose?—C. J. McG. says: Oblige me with a receipt for making colored crayons.—B. P. H. says: Be so kind as to inform me how a solution for removing ink is made?—T. F. McD. says: Please give a receipt to make an easy-running bismuth solder?—T. J. says: Can you furnish me with the receipts by which billiard balls are colored? Also how are the stripes on pool balls done?—P. H. H. says: Is there any kind of a cement that will stick brass to glass so that when a heavy charge of electricity comes over the wires it will not melt the cement? 2. Can you temper a drill so that you could drill a hole in glass, and how?—A Reader asks how to clean wall paper.—C. H. C. asks for tin and zinc plating baths.—E. C. W. asks for a durable whitewash.

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column. A new circular is now ready.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the number therein given:

Removal of White Incrustation from Bricks.—Large quantities of the pressed bricks referred to in query No. 4054, February 27, are made near here. Hydrochloric acid, dilute 1 in 3 water, and put on with a whitewash brush, will take off the white referred to.—*W. D. B., Milton, Ontario.*

NEW BOOKS AND PUBLICATIONS.

THE MECHANICAL ENGINEER'S POCKET BOOK OF TABLES, FORMULA, RULES, AND DATA. By D. Kinnear Clark, M. Inst. C.E. New York: D. Van Nostrand Co. 1892. Pp. xxxii, 656. Price $3.

A book of this character, provided with an extended table of contents and also with a full index is always welcome. The work covers the ground designated by its title, with one noteworthy feature. This is the introduction of a considerable part devoted to electrical engineering, including, among other topics, dynamos, lamps, conductors, telephones, and lighting conductors. The preface states that the work is especially designed for the use of the mechanical engineer, and its numerous tables and practical rules and examples will prove of the greatest use to members of the profession in question.

NOTES ON BUILDING CONSTRUCTION. Part IV. Illustrated with cuts and folding plates. London and New York: Longmans, Green & Co. 1891. Pp. xix, 364. Price $4.50.

This large and beautifully made volume is written to meet the requirements of the syllabus of the Science and Art Department of the committee of council on education, South Kensington, England, for what is termed the course for honors. Whether the English examination system is productive of good or harm to the cause of education is an open question. Its influence on the world of books is in some ways bad as tending to restrict the scope of books to the limited "requirements" of the examinations. This volume, however, while avowedly written for such end, treats so fully of its subject, building structures and calculations incident thereto, that it will be found valuable to many besides the mere crammer for the "honors" of a South Kensington examination.

HOW TO RUN ENGINES AND BOILERS. By Egbert P. Watson. New York, 1892. Pp. 125.

This is a little hand book of useful information and direction by the editor of the *Engineer*, designed to be particularly serviceable to young engineers and steam users. It treats of cleaning the boiler and removing scales, boiler fittings, grate bars and tubes, bridge walls, etc., and several short chapters are given to the slide valve throttling engine. Many valuable practical hints relative to engine running and management are given, and the information contained in the book is set out so plainly and clearly that the most ordinary mechanic cannot fail to understand and appreciate its contents.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

March 15, 1892.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid in oils and fats, dissolving lactic, A. Sommer 470,715
Acids in oils and fats, solution of, A. Sommer 470,714
Acids, making oxymethoxybenzoic, B. R. Seifert 470,920
Advertising match box, Harrison & Hooker 471,052
Air and gas meter, G. E. Abrahams 470,814
Air compressor and reservoir, J. G. Haines 470,934
Air moistening apparatus, E. Mertz 470,693
Air or gas meter, H. Lane 470,826
Ammunition car, rotating, H. A. Spiller 470,955
Annunciator, A. H. Brintnell 470,831
Arc light hanger, C. A. Pfluger 470,766
Auger, earth, G. P. Vicken 470,725
Awning, F. A. Leavitt 470,894
Axle, car, A. Alford 470,651
Axle lubricator, T. H. Fox 470,998
Axle skelp, L. D. Hill 470,787
Badge, C. A. Tripp 471,039
Bag. See Bicycle bag.
Baling press, A. Mattijetz 471,012
Banjo, J. W. Clement 470,986
Barrel stand, T. F. Marshall 471,010
Barrels, etc., machinery for shaping, finishing, and flanging metal, T. C. Barraclough 470,737
Basket, F. & H. Jepsen 470,680
Basket for marketing fruit, M. B. Williams 470,732
Battery. See Galvanic battery. Secondary battery.
Bed bottom, folding, S. Raymond 470,706
Beehive, U. G. Matthew 470,789
Belt, straightening, C. R. P. Klem 470,839
Bicycle bag, E. W. Mease 470,878
Bicycle lock, A. W. Hall 470,836
Binder for filing and binding papers, G. A. Huewe 471,055
Blacksmith's vise, G. R. Moore 470,764
Boiler furnace, J. F. Wangler 470,726
Bolt. See Joint bolt.
Bolts for doors, manufacture of cases and staples of sockets, G. Clarke 470,985
Book, W. Chichester 470,861
Bookbinding A. C. Hafely 470,866
Boring machine, J. Richards 470,879
Bottle for mucilage, etc., C. M. Higgins 471,003
Bottle stopper fastener, J. Menke 471,013
Box. See Fare box. Jonrnal box. Letter box. Sheet metal box. Show box. Stuffing box. Work box.
Box fastener, S. S. Barrett 470,968
Bracelet gauge, W. Jones 470,684
Bracket. See Scaffold bracket.
Brake. See Car brake. Wagon brake.
Brick mould sander, C. A. Adams 470,963
Brooms, etc., holder for, Smith & Harding 470,890
Bucket, iron, W. & A. McLauchlan 470,947
Buckle, J. F. Ballard 470,652
Buildings, construction of, W. T. Sears 470,901
Bung, C. R. Martin 471,011
Burial apparatus, C. C. Shults 470,767
Burner. See Hydrocarbon burner.
Butter tub closure, O. Duesler 470,835
Button, link, F. E. Williams 470,731

© 1892 SCIENTIFIC AMERICAN, INC.

Cake dish, T. H. & A. M. Ressler 470,827
Calipers, W. F. Durand 470,912
Camera, A. B. Dobbs 470,783
Can. See Oil can.
Can nozzle, oil, C. W. Beehler 470,776
Can opener, W. H. Shay 470,710
Candy cream heater and cooler, H. Heide 470,822
Cane, Chapman & Gash 470,873
Cane juice and other saccharine liquors, treating, H. E. Niese 471,060
Car brake, J. Morrow 471,014
Car brake, automatic, W. T. Rickman 471,022
Car brakes, king post for, W. M. Johns 470,682
Car coupling, W. H. Borchers 470,976
Car coupling, A. Parkinson 471,019
Car coupling, L. S. Riggs 471,023
Car coupling, J. R. Williamson 471,045
Car driving mechanism, T. A. Edison 470,927
Car, dumping, S. W. Bradley 470,658
Car frames, carling socket for, W. E. Coffin 470,744
Car motor, electric, F. O. Blackwell 470,656
Car, railway, T. A. Bissell 470,799
Car replacer, N. S. Scott 471,017
Car starter, W. Grenow, Jr 470,753
Cars, apparatus for heating railway, I. W. Bliss 470,380
Cars, device for heating, H. Newman 471,016
Carpet sweeper, S. H. Raymond 471,086
Carriage curtain light, F. A. Neider 470,639
Carriage tops, bow rest for, S. W. Childs 470,382
Carrier. See Cotton sack carrier. Trace carrier.
Cartridge holder, D. Lane 470,840
Carving machine, J. E. Brielmaier 470,659
Case. See Thread and needle case.
Cash drawer and recorder, combined, W. F. Brown 470,742
Caster, C. J. Lange 470,870
Catamenial sack or bandage, E. H. Carpenter 470,983
Cattle guard, G. A. Christ 470,662
Chain, drive, J. A. Stone 470,718
Chairs, rocking attachment for, W. H. Roach 471,080
Chamber or commode pot, J. Finsterer 470,887
Chisel, excavating, J. F. Koellhoffer 470,940
Cigar measure, J. C. Fernandez 470,999
Circuit interrupting device, A. Wurts 470,772, 470,773
Circuit protecting apparatus, A. Wurts 470,774
Closet. See Water closet.
Cloth tentering machine, A. Bradbury 470,741
Clothes line reel, J. Hoffmeister 470,674
Clothespin, W. J. Blakey 470,975
Clothes pounder, A. Rousseau 471,025
Coat loop or hanger, W. H. Kates 470,685
Coffee pot, F. H. Abell 470,979
Coffin handle, L. E. Woodard 471,047
Coin assorting and change delivery machine, T. J. McArthur 470,812
Coin freed apparatus, F. W. Jacob 470,758
Coke oven, R. De Soldenhoff 471,053
Combination lock, W. H. Thompson 470,720
Contact maker, D. Draper 470,994
Conveyance, wheeled, D. Madden 470,841
Conveyer or elevator, endless, J. W. Reno 470,918
Conveying apparatus, C. M. North 470,948
Cooking utensil, G. W. Merk 471,058
Cooler. See Milk cooler. Water cooler.
Corks from bottles, device for removing, E. J. Lumley *et al* 471,057
Corn popper, D. Swenson 470,882
Corn separating screen, C. & J. Closz 471,072
Cotton bolls, ripening, S. & S. W. Weis 470,771
Cotton gin, roller, W. Dearborn 471,076
Cotton opening machine, E. W. Kelley 470,937
Cotton sack carrier, Warren & Johnson 471,042
Coupling. See Car coupling. Locomotive draw bar coupling. Thill coupling.
Cultivator, D. H. Bull 470,979
Cup. See Oil cup.
Current generator, alternating, T. A. Edison 470,928
Cutter. See Vegetable cutter.
Dental disk holder, S. F. Gilmore 470,670
Disinfecting apparatus, F. Andre 470,966
Draught equalizer, H. O. Sorkness 470,716
Drawer for holding index cards, H. E. Davidson 470,884
Dock, dry, M. T. Endicott 470,750
Door fastener, A. Kennedy 470,857
Dynamo, W. H. Elkins 470,784, 470,785
Electric circuits, tell-tale device for, E. Tregoning 470,722
Electric conductor, T. A. Edison 470,924
Electric conduit, underground, J. F. Munsie 470,946
Electric connector, W. H. Garland 470,820
Electric elevator, R. C. Smith 471,063, 471,064
Electric machine, dynamo, T. A. Edison 470,930
Electric machine or motor, dynamo, T. A. Edison 470,926
Electric switch, S. Deacon 470,748
Electric switch, Moore & Jarrard 470,790
Electric wire support, F. O. Blackwell 470,844
Electrical apparatus protector, C. H. Morse 470,697
Electrical energy to a distance, transmission of, Deprez & Carpentier 470,865
Elevator. See Electric elevator. Hydraulic elevator.
Elevator safety device, H. R. Tracy 470,960
Engine. See Steam engine.
Engine cut-off mechanism, steam, E. P. Cowles 470,863
Envelope, M. S. Chapman 470,743
Fare box, Haigh & Exley 470,933
Faucet, measuring, J. H. Stutt 470,881
Feed water heater, J. Bell 470,972
Fence wire, manufacture of barbed, J. D. Curtis 470,746
Finger ring, J. H. Fink 470,751
Fire box and grate, J. A. Jamison 471,005
Fire escape, folding safety, G. H. Lee 470,689
Flushing tank, G. W. Davis 470,782
Foot rest, C. A. Lee 470,688
Fume, bag room for the collection of, F. L. Bartlett 470,970
Furnace. See Boiler furnace. Hot air furnace. Metallurgical furnace.
Furnaces, hot air pipe attachment for, C. L. Beers 470,829
Furnaces, working open-hearth, C. Siemens 470,713
Gauge. See Bracelet gauge. Printing press feed gauge. Water gauge.
Galvanic battery, F. H. Root 470,792
Game apparatus, A. W. McArthur 470,765
Game apparatus, J. C. Meem 470,691
Gas and air mixer, R. W. Clark 470,862
Gas, purifying water, H. S. Blackmore 470,974
Gate. See Railway gate.
Generator. See Current generator.
Governor, steam engine, D. A. Barnes 471,048
Grain binders, needle for, H. M. Weaver 470,852
Grain meter, C. D. Sprague 471,084
Grain screen, C. & J. Closz 471,073
Grate, fireplace, W. E. Fitch 470,855
Grater, I. S. Lauback 470,807, 470,808
Gravel, etc., apparatus for washing and grading, N. Jewett 470,681
Grinding flint, stone, bone, glaze, etc., construction of mills for, H. Cotton 470,833
Guard. See Cattle guard. Railway cattle guard. Railway track cattle guard. Window guard.
Guns, appliance for sighting, L. M. Von Markhof 470,942
Hame, D. Devoll 470,993
Hame, J. H. Knisley 470,939
Hammer, J. H. Fredericks 470,889
Hand hole cover, A. F. Hall 471,051
Handcuff, H. W. Kahlke 470,969
Handle. See Coffin handle. Tool handle.
Handle for wash boilers, etc., J. I. Flanagen 470,888
Hanger. See Arc light hanger.
Harness pad, J. S. Powell 470,917
Harrow, W. Sobey 471,032
Harrow, disk, A. Kaburick 470,760
Harrow, disk, F. Kaburick 470,761
Harvester, cotton, Cunningham, Sr., & Dingee 471,074
Hat brushing machine, felt, J. & O. Oldham 471,018
Head rest, J. H. Barth 471,049
Heater. See Candy cream heater. Feed water heater. Tire heater. Water heater.
Heating apparatus, H. J. Wattles 470,727
Hinge, spring, A. J. McCauley 471,059
Hoe, H. Burritt 470,981
Hoisting device, I. C. Welter 470,730
Holdback, vehicle, R. E. Daniels 470,834
Holder. See Cartridge holder. Dental disk holder. Jar holder. Opera glass holder. Order holder. Paper holder. Pen holder. Rein holder. Ribbon holder. Sandpaper holder. Sash holder. Stub holder.
Honey section press, W. O. Leach 470,893
Hook. See Snap hook.
Horseshoe calk, W. Pearce 470,702
Horseshoe, weighted, C. N. Barton 470,815
Horseshoeing rack, Tompkins & Schneiter 470,958
Hot air furnace, L. J. Trecy 471,038
Hub bands, cover for the ends of, J. Maris 470,895
Hydrant, J. Redican 470,842
Hydraulic elevator, G. W. Jones 470,936
Hydrocarbon burner, C. Siemens 470,711
Indicator. See Time indicator.
Inkstand fountain attachment, J. H. Hamill 471,002
Insulation for electric wires, S. Vanstone 470,883
Invalid lift, H. G. Monkhouse 470,944
Jar holder, W. G. Cummins 470,846
Joiners' work, device for fixing, J. Hartley 470,672
Joint bolt, E. H. Duchemin 470,995
Journal box, G. F. Godley 471,069
Key ring and pencil, combined, H. P. Fairchild 470,997
Knife. See Pocket knife.
Knitting machine, F. A. Calley 470,909
Knitting machine, circular, T. R. Houseman 470,757
Knob fastening device, sheet metal, E. L. Rogers 470,919
Lamps, manufacture of filaments for incandescent, T. A. Edison 470,922
Lamps, manufacture of filaments for incandescent electric, T. A. Edison 470,925
Lanterns, dissolving mechanism for magic, P. A. Bradford 470,907
Lath, sheathing, I. G. Jenkins 470,759
Lawn trimmer, H. C. Rice 470,950
Leather sides, off-bearing pole for, B. Schnepp 470,872
Letter box, F. P. Hubbard 470,803
Lifter. See Transom lifter. Truck lifter.
Lightning arrester, G. M. Bacon 470,736
Lightning arrester, E. Thomson 470,721
Lock. See Bicycle lock. Combination lock. Loom shuttle bobbin lock. Nut lock. Show case lock.
Locomotive, J. B. Mahana 471,009
Locomotive attachment for signals, T. E. Hill 470,877
Locomotive draw bar coupling, W. P. Prendergast 470,897
Locomotive engines, draught regulator for, E. E. Winkley 470,733
Locomotives, smoke-exhausting apparatus for, C. Anderson 470,965
Loom picker strap, W. H. Chace 470,984
Loom shuttle bobbin lock, R. P. Pearson 470,703
Loom take-up arrester, G. W. Walker 470,961
Loop-taker and actuating mechanism therefor, H. R. Tracy 470,796
Lubricator. See Axle lubricator. Piston lubricator.
Lubricator, N. Guyer 471,001
Magnet for dynamos, field, G. E. Dorman 470,749
Magnetic separator, T. A. Edison 470,929
Manuscript holder for speakers, C. C. Bowen 471,067
Manuscripts, device for moving and displaying speakers', C. C. Bowen 471,066
Metal cross tie, G. W. Stevenson 470,795
Metal wheel, J. R. Little 470,941
Metallurgical furnace, C. Siemens 470,712
Meter. See Air and gas meter. Air or gas meter. Grain meter.
Milk cooler, J. W. Ledbetter 470,849
Mill. See Sawmill. Windmill.
Mince meat machine, G. L. Merrell 470,692
Mixer. See Gas and air mixer.
Motor. See Car motor. Railway motor.
Mowing machine knife grinder, J. W. Watson 470,905
Nut lock, I. F. Bissell 470,973
Nut lock, Jaynes & Hawkins 470,677
Nut lock, W. Schauweker 470,708
Nut warmer, C. E. Raper 471,021
Oat screen, C. & J. Closz 471,071
Oil can, C. W. Hart 470,837
Oil can, R. McVicar, Jr 471,085
Oil cup, F. D. Winkley 470,734
Oil, desulphurizing, J. A. Dubbs 470,911
Opera glass holder, detachable, J. P. Hinkel 471,082
Order holder, G. A. Huewe 470,824
Ore concentrator, G. L. Cudner 470,781
Organ, J. A. Hultman 470,868
Organ pedals, attachment for, R. B. Shaw 470,709
Pad. See Harness pad.
Pad support and pencil holder, combined, G. W. Fisher 470,668
Paper holder, toilet, F. M. Whitelaw 470,906
Paper jogger, W. Reiffel 470,898
Paper piano cover, R. M. Webb 471,043
Penholder, H. J. Kennedy 470,938
Pick point, adjustable, H. Welisch 470,853
Pillow, G. H. Davis 470,819
Pin. See Clothespin.
Pipe. See Sheet metal pipe. Strake-weld pipe.
Pipe thimble, A. B. Carll 470,845
Pipe wrench, J. Landwehr 471,078
Pipes, plumber's fastening strap for lead, J. G. Murdock 470,698
Piston lubricator, C. M. Dreyer 471,068
Planter, J. Kelly 470,686
Planter, corn, W. Cattell 470,661
Planter, corn, J. Keys 470,762
Plastering composition, W. Robinson 471,081
Plow, L. S. Flatau 470,913
Plow attachment, T. B. Fagan 470,886
Pocket knife, C. E. Billings 470,777
Precious metals by amalgamation from ores or materials containing them, apparatus for separating, R. E. Shill 470,921
Press. See Baling press. Honey section press.
Presses, clutch and stop mechanism for, F. Wheeler 470,7
Printing press feed gauge, platen, F. S. Horner 470,675
Protector. See Electrical apparatus protector.
Pulley or wheel, split, J. J. Scholfield 470,952
Pump, F. A. Morand 470,695
Pump, vacuum, A. H. Dodd 470,847
Punching and cutting machine, metal, G. E. Hopkin 471,094
Purse, hand, E. J. Green 471,000
Puzzle, S. Sterne 470,717
Quilting machines, doubling attachment for, H. G. Pounds 471,020
Rack. See Horseshoeing rack.
Rail fastening, W. H. Mattson 470,943
Railway and drawbridge signal, T. E. Hill 470,875
Railway cattle guard, G. A. Christ 470,663
Railway cattle guard, Garaghty & Worthington 470,801
Railway circuit closer, F. E. Kinsman 470,806
Railway, electric, E. M. Bentley 470,654
Railway frog and switch, combined, D. Horrie 471,004
Railway gate, N. Van Winkle 471,040
Railway motor, electric, F. O. Blackwell 470,817
Railway plant, elevated, Day & Moody 470,992
Railway signal, T. E. Hill 470,876
Railway signal, electric, A. J. Wilson 470,813
Railway signaling, T. A. Edison 470,923
Railway switch, automatic, Morris & Nace 470,696
Railway tie, R. Osborne 470,700
Railway tie, metallic, A. W. Straub 470,904
Railway time signal, H. Gosman 470,821
Railway track cattle guard, A. E. Shorthill 471,029
Railways, contact device for electric, F. O. Blackwell 470,657
Ratchet wrench, J. E. Sinclair 470,954
Rattle, campaign, F. A. Wilskey 471,046
Razor, safety, E. & G. A. Scharff 471,070
Reamer, adjustable, P. Weber 470,962
Recorder. See Time recorder.
Reel. See Clothes line reel.
Reflector, N. M. Abbott 470,854
Register, C. Michaelsen 470,694
Regulator. See Temperature regulator.
Rein holder, T. A. Jones 470,683
Ribbon holder, J. C. Abbott 470,775
Ring. See Finger ring. Key ring.
Rock catcher, G. W. Veronee 471,041
Rolling machine, R. H. Brown 470,908
Rolling screws, method of and means for, H. K. Jones 470,805
Rule, key seat, S. Darling 470,864
Ruler and paper cutter, combined, G. Hartig 470,754
Safe, Damon & Adams 470,818
Sand paper holder, W. Shempp 470,794
Sash balance, W. Berry 470,655
Sash fastener, W. Coulter 470,988
Sash fastener, D. O. Livermore (r) 11,230
Sash fastener, W. M. Morton 470,945
Sash fastener, M. B. Reynolds 470,791
Sash fastener, W. M. Taber 470,719
Sash holder, G. Heffner 470,914
Saw machine, drag, J. W. Calef 470,779
Sawmill, combined band and circular, H. J. Andersen 470,964
Saw tooth, R. J. Bamford 470,967
Saw tooth, W. E. Brooke 470,977
Saws, roller guide for hoop pole band, B. F. Veach 470,724
Scaffold bracket, A. W. Guthat 470,856
Screen. See Corn separating screen. Grain screen. Oat screen.
Screwdriver, J. Koelzer 470,687
Screwdriver attachment, L. H. Boyden 470,778
Screw, wood, H. K. Jones 470,804
Seaming machine, sheet metal, C. Hoff 470,755
Secondary battery, Parker & Crapo 470,701
Seeder and gang plow, combined, M. C. Egan 471,050
Separator. See Magnetic separator.
Separators, carriage for, A. C. Hopkins 470,867
Sewers, flood gate for, E. E. Fitzpatrick 470,669
Sewing machine, J. H. Griffin 470,891
Sewing machine, W. Y. Ober 471,017
Sewing machine feeding mechanism, H. R. Tracy 471,036
Sewing machine loop taker, H. R. Tracy 471,035
Sewing machine shuttle-actuating mechanism, H. R. Tracy 471,037
Sewing machine table, H. R. Tracy 470,959
Sewing machine thread-unwinding device, Howe & Bush 471,054
Sewing machine treadle, swinging, C. W. Smart 470,843
Sheet metal box, E. W. Mersereau 470,859
Sheet metal pipe, T. C. Belding 470,739
Sheet metals, apparatus for galvanizing, M. Bayliss 471,065
Shingle sawing machine, S. English 470,996
Shoe shank stiffeners, making, J. Lowe 470,763
Show box, C. Dietz 470,885
Show case lock, E. E. Heath 470,673
Signal. See Railway and draw bridge signal. Railway time signal.
Signal apparatus, combined police and fire alarm, L. B. Firman 470,667
Signals, apparatus for setting torpedo, C. A. Weiler 470,729
Signaling apparatus, electrical hose, W. Fowler 470,752
Signaling apparatus, police and fire alarm, L. B. Firman 470,666
Signaling apparatus, switch for electric, L. Sellner 470,793
Skylight, B. F. Parrott 470,896
Slicing machine, T. Coldwell 470,987
Snap hook, H. N. Bull *et al* 470,980
Snow plow, J. W. Russell 470,951
Split wheel, J. J. Scholfield 470,953
Spoke socket, J. B. Righter 471,024
Spoon, A. F. Jackson 470,676
Spring, G. L. Potter 470,949
Square and rule, dressmaker's, F. Long 470,809
Stand. See Barrel stand.
Stay, dress, C. Burger 470,660
Steam engine, H. J. Conant 470,664
Stirrup, G. E. Tucker 470,770
Stone cutting and dressing tool, Lachapelle & Devine 470,788
Stop motion device, R. Whitaker 471,044
Stove, vapor, C. M. Hollingsworth 470,756
Strake weld pipe, J. C. Bayles 470,738
Strap. See Loom picker strap.
Straw binder, G. Elrick 470,665
Stub holder, C. W. Martin 470,690
Stuffing box, F. Bauer 470,971
Sugar, apparatus for cooling hot liquid, H. Heide 470,823
Surveyors' instruments, tripod head for, G. Hannes 470,802
Switch. See Electric switch. Railway switch.
Switch and signal operating apparatus, G. H. Pfeil 470,916
Syringe, H. J. Maris 470,811
Table. See Sewing machine table.
Table, M. Dexter 471,077
Tag package, A. R. Tiffany 470,956, 470,957
Tag wiring machine, A. R. Tiffany 470,957
Tank. See Flushing tank.
Tank feeder, Burt & Skilton 470,982
Telegraph, printing, E. J. Silkman 470,768
Telephones, appointment signal for, S. W. Gray 470,786
Temperature regulator, Bell & Root 470,653
Tent, tourist's, N. A. B. Schou 470,900
Thill coupling, E. E. Kimball 470,892
Thill coupling, S. J. Stevens 470,903
Thrashing machines, feeder and spreader, for, S. G. Gilbert 470,932
Thread and needle case, H. Rogers 470,850
Tie. See Metal cross tie. Railway tie.
Time indicator and alarm, H. Bennett 470,816
Time recorder, employe's, Lucas & Garrett 470,810
Tire for bicycles, cushion, W. C. McIntire 470,915
Tire heater, S. M. Jenks 470,678
Tire heater, gasoline, S. M. Jenks 470,679
Tongue support, B. F. Foster 470,931
Tool handle, W. L. Smith 471,031
Torpedoes, means for exploding, W. Ramsden 470,705
Toy, wheeled, J. P. Caulfield 470,860
Trace carrier, S. G. Jackson 470,848
Transom lifter, G. A. Colton 470,780
Trimmer. See Lawn trimmer.
Truck, car, C. F. Heath 470,935
Truck, car, E. Peckham 471,061, 471,062
Trunk lifter and shifter, overhead, H. A. Vose 470,851
Tubular fabrics, apparatus for shaping, D. A. Cobb 470,800
Turning irregular forms, machine for, E. A. Kimball 471,006
Typewriters, blankbook for, C. G. Thomson 470,769
Typewriting machine, W. J. Barron 470,969
Typewriting machine, J. D. Daugherty 470,990
Typewriting machine, C. Glidden 470,874
Typewriting machine, J. Pratt 470,704
Typewriting machine, C. Rymtowti-Prince 470,871
Umbrella runners, device for fastening, W. H. Gaskill 470,890
Valve, automatic, R. Wood 470,735
Valve, engine, F. W. Bruce 470,978
Valve gear for steam hammers, S. Trethewey 470,723
Valves for steam engines, means for automatically operating throttle, F. E. Kinsman 470,825
Vegetable cutter, F. A. Grellet 470,671
Vehicle, Ruch & Stair 471,026
Vehicle bodies, etc., tool for rubbing down, W. M. Davis 470,991
Vehicle running gear, J. R. Kunzelman 471,007
Vehicle seats, spring for supporting, S. L. Saunders 470,707
Velocipede treadle, Curtis & Perkins 471,075
Vending machine, electric-actuated, A. J. Henry 471,053
Violin bow, F. Searle 471,028
Wagon brake, G. D. Smith 471,030
Washing machine, roller, E. A. Rusden 470,828
Water closet, ventilated, C. A. Bluhm 470,740
Water cooler, H. J. Conant 470,745
Water gauge, R. Klinger 470,858
Water heater, L. L. Culver 470,989
Welt trimming machine, J. H. Ricker 471,079
Wheel. See Metal wheel. Split wheel.
Wheels, making metal, J. R. Little 471,008
Whistle harp, J. P. Nessle 471,015
Wick adjusting device, W. C. Homan 471,083
Windmill, P. Clemens 470,910
Window guard, L. B. Lewis 471,056
Wire, barbed, J. D. Curtis 470,747
Wood and other surfaces, decorating, T. Robinson 470,899
Work box, C. Weiss 470,728
Wort, method of and apparatus for producing, Sobotka & Kliemetschek 470,902
Wrench. See Pipe wrench. Ratchet wrench.

DESIGNS.

Clasp, J. A. Traut 21,400
Dish, E. Pouyat 21,406
Game board, A. M. Warner 21,401
Handle for button hooks, etc., H. P. Fairchild 21,403, 21,404
Harness snap, E. L. Howe 21,398
Hat and towel rack, J. Danner 21,407
Monument, W. H. Perry 21,410
Purse or bag frame, A. Goertz 21,397
Scrubber holder, M. H. Grubb 21,405
Snap hook, J. W. Harriss 21,399
Spoon, souvenir, A. H. Peiffer 21,409
Spoon, souvenir, C. H. Ways 21,402
Toy whistle, T. A. Myers 21,408

TRADE MARKS.

Aluminum and its alloys, G. A. Tompkins 20,853
Beer, lager, John Kress Brewing Company 20,834
Belting, belt, lace, picker, hame string, and leggin leather, picker straps, hame strings, and cut lacings, leather, Page Belting Company 20,833
Belting, hose, and packing, rubber, Revere Rubber Company 20,848
Bicycles, tricycles, and other velocipedes and parts of the same, C. H. Pugh 20,839
Candy of all kinds, manufactured, Hall & Hayward Company 20,843
Canned fruits and vegetables, Martin Wagner Company 20,846
Clam bouillon, E. S. Burnham 20,829
Cloth, gray, T. L. Pomeroy 20,847
Collars and cuffs, waterproof, Arlington Collar and Cuff Company 20,850, 20,851
Fertilizing compositions, J. D. Little 20,845
Gelatine, Cushman Bros. 20,837
Lard, Jersey City Packing Company 20,844
Oil, illuminating, Scofield, Shurmer & Teagle 20,840
Perfumery, soap, and toilet and tooth powder, Jordan, Marsh & Co 20,830, 20,831
Pills, G. T. Fulford 20,838
Pyroxyline or its compounds, material composed wholly or in part of, Arlington Manufacturing Company 20,852
Railway service, air brake apparatus for, Westinghouse Air Brake Company 20,849
Scissors, Milton Bradley Company 20,828
Sewing machines and attachments, Johnson, Clark & Co 20,832
Soap and perfumery, perfumed, Zeno & Co 20,876
Specific for throat and lung troubles, J. B. Daniel. 20,841
Wines, Empire State Wine Co 20,842
Wines and liquors, California, C. Schilling & Co 20,835

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print, issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

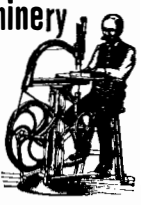
Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

ADAMANT WALL PLASTER
BEST PLASTERING MATERIAL KNOWN.
No experiment. Its success has been phenomenal.
Thirty factories in this and other countries.
ADAMANT MFG. CO., SYRACUSE, N. Y.

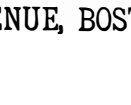
Patent Foot Power Machinery
Complete Outfits.

Wood or Metal workers without steam power, can successfully compete with the large shops, by using our New LABOR SAVING Machinery, latest and most improved for practical shop use, also for Industrial Schools, Home Training, etc. Catalogue free.
Seneca Falls Mfg. Co.
695 Water Street, Seneca Falls, N. Y.

FRET SAW or BRACKET WOODS
Planed Ready for Use. Books of Design.
Send stamp for catalogue.
CABINET WOODS AND VENEERS.
THE E. D. ALBRO CO.,
Eastern Branch, 200 Lewis St., New York, U. S. A.
H. T. Bartlett, *Mgr.* F. W. Honerkamp, *Ass't Mgr.*
Mills, Cincinnati, Ohio.

Improved Screw Cutting Foot and Power. LATHES
Drill Presses, Shapers, Band, Circular, and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial.
Catalogue mailed on application.
SEBASTIAN LATHE COMPANY,
44-46 Central Ave., Cincinnati, O.

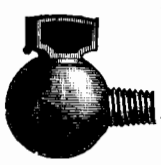
Hatch Chickens by Steam.
IMPROVED EXCELSIOR INCUBATOR

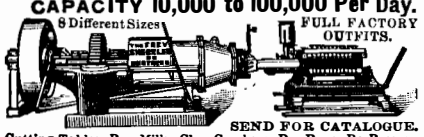
Will do it. Thousands in successful operation. *Simple, Perfect and Self-Regulating.* Lowest-priced first-class Hatcher made. Guaranteed to hatch a larger percentage of fertile eggs at less cost than any other.
Send 6c. for Illus. Catalog. GEO. H. STAHL, Quincy, Ill.


WOODEN TANKS. LARGE WATER TANKS PLANS & CA SPECIALTY. SPECIFICATIONS FURNISHED FOR FOUNDATIONS & TOWERS.
FOR RAILROADS WATER WORKS MILLS, FARMS &C. COMPLETE STOCK OF CYPRESS LUMBER.
W. E. CALDWELL & CO
N° 217 E. MAIN ST. LOUISVILLE KY.

The Sebastian-May Co.
Improved Screw Cutting Foot & Power LATHES

Drill Presses, Chucks, Drills, Dogs, and Machinists' and Amateurs' Outfits. *Lathes on trial.* Catalogues mailed on application.
165 to 167 Highland Ave., SIDNEY, OHIO.


Van Duzen's Pat. Loose Pulley Oiler
HAS Highest Indorsements, Enviable Reputation, Scientific Pedigree.
A two years' test by conservative manufacturers of national reputation has shown it to be the *only perfect Lubricator for Loose Pulleys* in use. Prices very reasonable. Send for our "Catalogue Number 55."
VAN DUZEN & TIFT, Cincinnati, O

BRICK, TERRA COTTA AND TILE MACHINERY
CAPACITY 10,000 to 100,000 Per Day.
8 Different Sizes. FULL FACTORY OUTFITS.

SEND FOR CATALOGUE.
Cutting Tables, Pug Mills, Clay Crushers, Dry Pans, Re-Presses, Winding Drums, Dump Cars, Drying Cars, Transfer Cars, Turn Tables, Elevators, Screens, Shafting, Pulleys, Belting, Etc.
THE FREY, SHECKLER CO. BUCYRUS, O.

OVER 1200 BICYCLES in stock. New and second-hand. *Cash or time.*
A. W. GUMP & CO.
DAYTON, OHIO.
Send for list.
AGENTS WANTED.
BICYCLES, GUNS and TYPEWRITERS TAKEN IN EXCHANGE.

T. A. C. MARCH 1st to OCTOBER 1st. Sales of a patented specialty over two millions. Manufactured on royalty. Inventors, write us.
THE TUSCARORA ADVERTISING CO., COSHOCTON, O.

FREE ON APPLICATION
THE BABCOCK & WILCOX CO
30 CORTLANDT ST. N.Y.
107 HOPE ST. GLASGOW, SCOTLAND.
WATER TUBE
STEAM BOILERS
MANUFACTORIES IN UNITED STATES, SCOTLAND, FRANCE, GERMANY & AUSTRIA.
Awarded the Grand Prize at late Paris Exposition.

ELECTRIC POWER APPARATUS,
FOR EVERY VARIETY OF MECHANICAL WORK.
SAFE, SURE, RELIABLE.
ESTIMATES FURNISHED. SEND FOR CATALOGUES.
THOMSON-HOUSTON MOTOR CO.,
620 ATLANTIC AVENUE, BOSTON, MASS.

© 1892 SCIENTIFIC AMERICAN, INC.

A New and Important Book on Steam Engineering

Le Van's Great Work on

THE INDICATOR.

The Steam Engine and the Indicator: Their Origin and Progressive Development, including the Most Recent Examples of Steam and Gas Motors, together with the Indicator, its Principles, its Utility, and its Application. By William Barnet Le Van. Illustrated by 205 engravings, chiefly of Indicator Cards. 463 pp., 8vo.

Price $4.00 by mail, free of postage to any address in the world.

CONTENTS.—I. Introduction. II. Who invented the Steam Engine? III. Heat and Work. IV. Expansion. V. The Indicator. VI. The Action of Steam in the Cylinder of an Engine. VII. Horse Power. VIII. Diagrams showing the Action of Steam in Steam Engine Cylinder. IX. Correct Indicator Diagrams. X. Steam Expansion Curves or Pressure of Steam in Cylinder. XI. Comparative Indicator Diagrams. XII. Steam Jackets. XIII. Varieties of Steam Engines. XIV. Gas Engines. XV. Automatic Cut-Off *vs.* Positive Cut-Off. XVI. Miscellaneous. Appendix. Index.

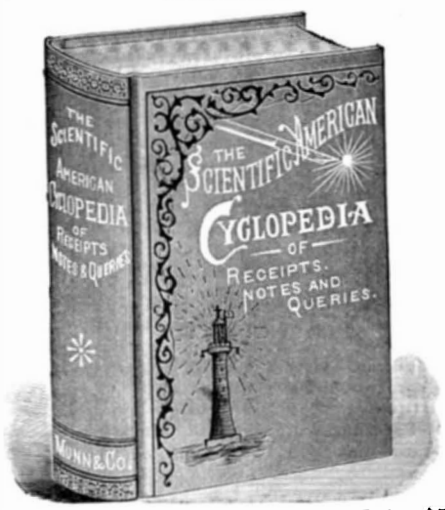
☞ *An illustrated circular of 6 pages, quarto, giving the full table of contents, with specimens of the engravings of this valuable book, will be sent free of postage to any one in any part of the world who will send us his address.*

☞ *Our new revised Descriptive Catalogue of Practical and Scientific Books, 88 pages, 8vo, and our Catalogue of Books on Steam and the Steam Engine, Mechanics, Machinery, and Dynamical Engineering, and other Catalogues the whole covering every branch of Science applied to the Arts, as well as a circular of "Van Cleve's English and American Mechanic," sent free and free of postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U. S. A.

JUST PUBLISHED.—"Ways and Means," for Machinists and Metal Workers. A new work, thoroughly practical, containing new matter that no intelligent mechanic would want to miss. The cheapest work ever issued. 160 pages, 150 illustrations, including working details of the latest machine tool design and practice. Bound in cloth. Price, $1.00. John W. Weston, Publisher, Journal of the Association of Engineering Societies, 78 La Salle Street, Chicago.

NOW READY!
A NEW AND VALUABLE BOOK.



12,000 Receipts. 680 Pages. Price $5.

This splendid work contains a careful compilation of the most useful Receipts and Replies given in the Notes and Queries of correspondents as published in the **Scientific American** during the past fifty years; together with many valuable and important additions.

Over Twelve Thousand selected receipts are here collected; nearly every branch of the useful arts being represented. It is by far the most comprehensive volume of the kind ever placed before the public.

The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form convenient for ready use.

Almost every inquiry that can be thought of, relating to formulæ used in the various manufacturing industries, will here be found answered.

Instructions for working many different processes in the arts are given.

It is impossible within the limits of a prospectus to give more than an outline of a few features of so extensive a work.

Under the head of Paper we have nearly 250 receipts, embracing how to make papier maché; how to make paper water proof and fire proof; how to make sandpaper, emery paper, tracing paper, transfer paper, carbon paper, parchment paper, colored papers, razor strop paper, paper for doing up cutlery, silverware; how to make luminous paper, photograph papers, etc.

Under the head of Inks we have nearly 450 receipts, including the finest and best writing inks of all colors, drawing inks, luminous inks, invisible inks, gold, silver and bronze inks, white inks; directions for removal of inks; restoration of faded inks, etc.

Under the head of Alloys over 700 receipts are given, covering a vast amount of valuable information.

Of Cements we have some 600 receipts, which include almost every known adhesive preparation, and the modes of use.

How to make Rubber Stamps forms the subject of a most valuable practical article, in which the complete process is described in such clear and explicit terms that any intelligent person may readily learn the art.

For Lacquers there are 120 receipts; Electro-Metallurgy, 125 receipts; Bronzing, 127 receipts; Photography and Microscopy are represented by 600 receipts.

Under the head of Etching there are 55 receipts, embracing practical directions for the production of engravings and printing plates of drawings.

Paints, Pigments and Varnishes furnish over 800 receipts, and include everything worth knowing on those subjects.

Under the head of Cleansing over 500 recipes are given, the scope being very broad, embracing the removal of spots and stains from all sorts of objects and materials, bleaching of fabrics, cleaning furniture, clothing, glass, leather, metals, and the restoration and preservation of all kinds of objects and materials.

In Cosmetics and Perfumery some 500 receipts are given.

Soaps have nearly 300 receipts.

Those who are engaged in any branch of industry probably will find in this book much that is of practical value in their respective callings.

Those who are in search of independent business or employment, relating to the home manufacture of sample articles, will find in it hundreds of most excellent suggestions.

MUNN & CO., Publishers,
SCIENTIFIC AMERICAN OFFICE,
361 Broadway, New York.

FREE
IT WILL COST YOU NOTHING.
Send us your address on a postal and you will receive the finest catalogue of PIANOS and ORGANS in the world. It will show you how to SAVE $100.
Satisfaction guaranteed before you pay. CUT THIS OUT and mail it to us. You will be surprised at the result. But you must do it NOW. Write to
CORNISH & CO. (Established 25 Years.) **WASHINGTON, New Jersey.**

STEEL TYPE FOR TYPEWRITERS

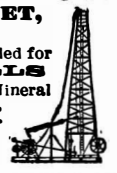
Stencils, Steel Stamps, Rubber and Metal Type Wheels, Dies, etc.
Model and Experimental Work
Small Machinery, Novelties, etc., manufactured by special contract.
New York Stencil Wks. 100 Nassau St., N.Y

"THE KRIEBEL" STEAM ENGINES.

STATIONARY. MARINE & HOISTING ENGINES WITH VERTICAL OR HORIZONTAL STEEL BOILERS. SEND FOR CATALOGUE
RICE & WHITACRE M'F'G.CO. CHICAGO.

OIL WELL SUPPLY CO.

91 & 92 WATER STREET,
Pittsburgh, Pa.,
Manufacturers of everything needed for
ARTESIAN WELLS
for either Gas, Oil, Water, or Mineral Tests, Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. Illustrated catalogue, price lists and discount sheets on request.



VELOCITY OF ICE BOATS. A COLlection of interesting letters to the editor of the SCIENTIFIC AMERICAN on the question of the speed of ice boats, demonstrating how and why it is that these craft sail faster than the wind which propels them. Illustrated with 10 explanatory diagrams. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **214.** Price 10 cents. To be had at this office and from all newsdealers.

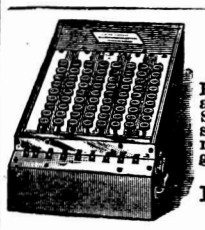
CLARK'S
WOOL WASHERS,
WARP DYEING AND SIZING MACHINES,
PATENT RUBBER COVERED SQUEEZE ROLLS,
POWER WRINGERS FOR HOSIERY AND YARN DYEING,
DRYING AND VENTILATING FANS,
WOOL AND COTTON DRYERS, Etc.
Catalogues free.
GEO. P. CLARK
Box L. Windsor Locks, Conn.

ARCHITECTURAL ENGINEERING—By J. Kendall Freitag. A presentation of a few facts in connection with the engineering part of the huge frameworks of metal and terra cotta that adorn our large cities of to-day. With 9 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **816.** Price 10 cents. To be had at this office and from all newsdealers.

PIANOS, ORGANS, VIOLINS & GUITARS

Sent anywhere on 10 days trial. Freight paid both ways Send for catalog & price list
THOMPSON MUSIC CO.
259 Wabash Ave., **CHICAGO.**
N. B.—Send 6c to pay postage and we will send 2 pieces of late music **FREE** and our large catalog of Sheet Music and Books with cut rates.

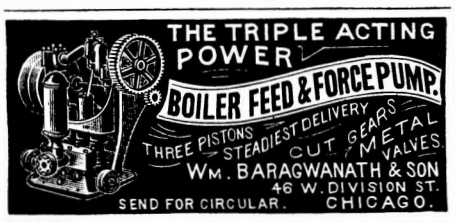
THE PENNA. DIAMOND DRILL & MFG. CO. BIRDSBORO, PA., Builders of High Class Steam Engines, Diamond Drills, Power and Hand Cranes, and General Machinery.



COMPTOMETER
TRADE MARK
Figures any and all kinds of examples. Operated by keys. Saves 60 per cent of time. Insures accuracy, and relieves all mental strain. Why don't you get one?
Send for circular.
FELT & TARRANT MFG. CO.
52-56 Illinois St., Chicago.

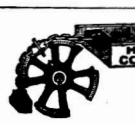
LEARN WATCHMAKING of W. F. A. Woodcock, Winona, Minn. Write for terms

---



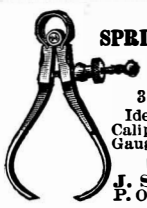
To Inventors.
E. Konigslow, manufacturer of **Fine Machinery and Models,** offers **Special Facilities to Inventors.** Guarantees to work out ideas in strictest secrecy, and *any improvement that he can suggest goes with the work.* Thousands of men have crude though really valuable ideas, which they lack mechanical training to develop. Novelties and patented articles manufactured by contract. **181 Seneca St., Cleveland, Ohio.**

$10.00 to $50.00 per night. A light and profitable business. **Magic Lanterns and Views** of popular subjects. Catalogues on application. Part 1 Optical, 2 Mathematical, 3 Meteorological, 4 Magic Lanterns, etc. **L. MANASSE, 88 Madison Street, Chicago, Ill.**



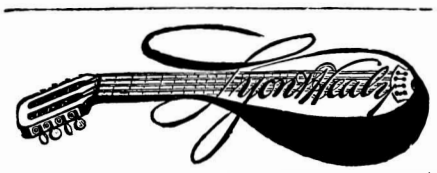
HARRISON CONVEYOR!
For Handling **Grain, Coal, Sand, Clay, Tan Bark, Cinders, Ores, Seeds, &c.**
Send for Circulars. **BORDEN, SELLECK & CO.,** { Sole Manu'f'rs, } **Chicago, Ill.**

PURE TEMPERED COPPER THE SAFEST, MOST DURABLE & ECONOMICAL METAL EVER OFFERED FOR VARIOUS MECHANICAL USES. HIGHEST ANTI-FRICTIONAL QUALITIES. INDISPENSIBLE FOR ELECTRICAL WORK. EUREKA TEMPERED COPPER CO., NORTH EAST, PA.



STEVENS PATENT
SPRING SCREW THREAD CALIPERS
Ideal, No. 64.
Price, by mail, postpaid.
3 inch.....$1.00 | 5 inch.....$1.25
Ideal and Leader Spring Dividers, and Calipers, Ideal Surface Gauges, Depth Gauges, and Fine Machinists' Tools.
☞ *Illustrated catalogue free to all.*
J. STEVENS ARMS & TOOL CO.,
P. O. Box 280. Chicopee Falls, Mass.

WOOD WORKING MACHINERY
For Veneer, Fruit Package and Barrel Works.
Handle, Spoke and Turning Factories.
I. E. Merritt Machinery Co., Lockport, N. Y.



GUITARS	MANDOLINS
The Marquette. Quarter-sawed Sycamore $7.50	**The Lakeside.** Variegated Birds-Eye Maple $12
The Lakeside. Quarter-sawed Oak, - - $9.00	**The Arion.** Maple and Mahogany - - $15
The Arion. Solid Mahogany, - - $11.00	**The Arion.** Same as preceeding, inlaid, $20
The Conservatory. Solid Rosewood, - - $13.50	**The Conservatory.** Solid Rosewood, - - - $20

Fully warranted and the best for the price the world affords. We manufacture all the component parts and are the largest makers on the globe. 100,000 of our instruments now in use. **Sold by all leading dealers.** Genuine have name burned on the inside. ☞ Take no other. Illustrated pamphlet mailed free.
LYON & HEALY, 156 to 164 State St., Chicago.

VOLNEY W. MASON & CO.,
FRICTION PULLEYS CLUTCHES and ELEVATORS
PROVIDENCE, R. I.

If you are interested in
ELECTRICITY
send for our special Price List Z.
BELLS, BATTERIES, PUSHES, WIRE, MOTORS,
And a full line of general
ELECTRICAL SUPPLIES,
STANLEY & PATTERSON,
Electrical House Furnishings,
32 & 34 Frankfort St., N. Y. City

FOR SALE. Patent Right for a new steam pipe and boiler covering. Address
J. W. CARRIER,
P. O. Box 1330, Boston, Mass.

Did you ever receive a letter? You can receive our Roses the same way—by mail, postpaid. The Californian or the Pennsylvanian can alike enjoy the advantage of dealing direct at the Rose headquarters of the world. Success is universal with our

ROSES ON THEIR OWN ROOTS

We desire the acquaintance of every flower lover in America, and offer our *Rose Guide and Catalogue,* **free,** by way of introduction. It mirrors our immense stock, and gives a quarter of a century's special flower experience for the asking only. **Other flowers also.** No fancy prices. The *Guide* without price. Send your address.
THE DINGEE & CONARD CO.
Rose Growers & Seedsmen, **WEST GROVE, PA.**

F. A. SINCLAIR'S
Common Sense Chairs, Settees, and Rockers

Fireside Comfort for Two.

Are just what their name implies. You cannot buy more sensible, easy seats. Ask your dealer for them, or send stamp for Catalogue to
F. A. SINCLAIR,
MOTTVILLE,
Onondaga Co'nty, N. Y.
Special low freight to all parts of the United States.

Machinists' Tools of every description, drop forged from bar steel, correct in design and unequaled in finish.
THE BILLINGS & SPENCER COMPANY,
HARTFORD, CONN.

Are you interested in
GATE VALVES?
If so, investigate the "**Handy.**" It will pay you. ☞ Write for Catalogue and mention this paper.
The Lunkenheimer Brass Mfg. Co.,
Cincinnati, Ohio, U. S. A.
☞ *Mention this paper.*

CELLULOID ZAPON Co. 41 BARCLAY ST. NEW YORK.
MANUFACTURERS OF CELLULOID LACQUERS AND VARNISHES FOR METAL AND WOOD
GUM LACQUERS—BRILLIANT AND DEAD BLACKS—SHELLACS &c.
SOLE LICENSEES OF THE CELLULOID COMPANY.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS. FINE TINNING, JAPANNING AND FINISHING.
THOMAS DEVLIN & CO., LEHIGH AVE. & AMERICAN ST. PHILA.

ELECTRO MOTOR, SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

CUMMER'S DRYER, PULVERIZER & CALCINER.
CLAY FROM BANK, DRIED @ 5 CTS. PER TON. ALSO VERY WET & PASTY MATERIALS.—PHOSPHATE ROCK, GYPSUM &c. CALCINED BY NEW CHEAP PROCESS. PULVERIZER FOR FINE GRINDING OF PAINTS, PHOSPHATE ROCK CEMENTS &c. — LARGE CAPACITY, VERY DURABLE. SEPARATOR HANDLES TO 80 MESH & FINER. 10 TO 20 TONS PER HOUR WITH 1-H.P.
MANF'C. FOR U.S. EXCLUSIVELY BY FRONTIER IRON WORKS, DETROIT, MICH. | SOLD EXCLUSIVELY BY F. D. CUMMER & SON DETROIT, MICH.

A NEW CATALOGUE OF VALUABLE PAPERS
Contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, New York.

CHUCKS. Catalogue No. 12, just issued with over 40 new illustrations sent free. Address,
The Cushman Chuck Co., Hartford, Conn.

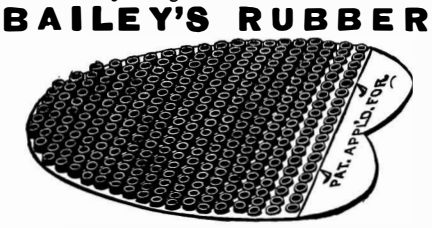
GATES ROCK & ORE BREAKER
Capacity up to 200 tons per hour.

Has produced more ballast, road metal, and broken more ore than all other Breakers combined.
Builders of High Grade Mining Machinery. Send for Catalogues.
GATES IRON WORKS,
50 C So. Clinton St., Chicago
136 C, Liberty Street, New York,
237 C, Franklin St., Boston, Mass

DEAFNESS & HEAD NOISES CURED by Peck's Invisible Tubular Ear Cushions. Whispers heard. Successful when all remedies fail. Sold only by F. Hiscox, 853 B'way, N.Y. Write for book of proofs. **FREE**

MARINER & HOSKINS ASSAYERS & CHEMISTS 81 CLARK STREET. CHICAGO.
SAMPLES BY MAIL OR EXPRESS

Everything in Rubber Goods.
BAILEY'S RUBBER



HEEL CUSHION
gives **elasticity and ease** to **every step** taken by the wearer. It breaks the **shock** or **jarring** of the body when walking, and is particularly adapted to all who are obliged to be on their feet. To those suffering from **Spinal, Kidney, Rheumatic,** and **Nervous Affections,** it will be found a great relief. The rubber with its annular projections is as **soft** as **velvet,** thoroughly vulcanized, always elastic, leather covered next to the foot, and can be instantly adjusted inside of the boot, directly under the heel. All sizes, **25 cents per pair,** mailed upon receipt of price. At all dealers.

What People Say Who Wear Them:
"Send 6 pairs more; they are a grand success."
"Entirely satisfactory; send 4 pairs more."
"They give instant relief, send me 3 pairs more."
Indorsed by physicians for nervous troubles.
C. J. BAILEY & CO., 22 Boylston Street, Boston.

MOSS ENGRAVING CO. 535 PEARL ST. NEW YORK.
Catalogue and FINE PRESS WORK A SPECIALTY.
OUR PROCESSES MOSS TYPE PHOTO ENGRAVING. ZINC ETCHING

Our new General Circular "S. A.," showing specimens of all our work, is now ready. Send stamp and particulars for estimates.

INVESTMENT.
Seventy persons with $200 each can secure quarter interest in a patent in 70 different counties. Reference given. Box 190, Orange City, Fla.

THE REMINGTON STANDARD TYPEWRITER

Is to-day, as it has ever been the leading Typewriter.

Carefully tested improvements are constantly added to this famous machine.

Send for Illustrated Catalogue.

TRY OUR PARAGON BRAND OF TYPEWRITER RIBBONS.

Wyckoff, Seamans & Benedict,
327 Broadway, New York.

© 1892 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

VICTORS MAKE THE PACE

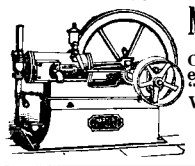
HIGHEST GRADE

CATALOGUE FREE

OVERMAN WHEEL CO.
BOSTON. WASHINGTON. DENVER. SAN FRANCISCO.
A. G. SPALDING & BROS., Special Agents,
CHICAGO. NEW YORK. PHILADELPHIA.

COMPLETE PLANTS 5 TO 50 LIGHTS **ELECTRIC LIGHT**
EVERYTHING NECESSARY IN A BOX. ALL CONNECTIONS MADE BEFORE SHIPPING. ELECTRICIAN NOT NECESSARY.
YOU CAN PUT IT UP YOURSELF. LIGHTS ARE STANDARD AND FULL SIZE.
THOROUGHLY RELIABLE AND PRACTICAL. PRICES REASONABLE. SEND FOR PAMPHLET.
BAIN ELECTRIC MANUFACTURING CO. CHICAGO.

DO U SEEK POWER?
We can supply it with the



Motor of the 19th Century
¾ to 70 horse power.
Cost about one cent an hour to each indicated horse power.
"*In worth, not size, my value lies.*"
What others think of me is stated in catalogue.
CHARTER GAS ENGINE CO.
P. O. Box 148, Sterling, Ill.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

HARTFORD, CONN.

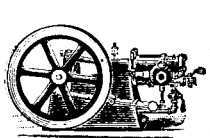
THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones in fringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 59. Price 10 cents. To be had at this office and of all newsdealers.

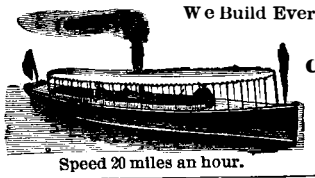
ELECTRO VAPOR ENGINE.
GAS OR GASOLINE FOR FUEL.
NO BOILER. NO FIRE. NO DANGER. NO ENGINEER.



Engine operated by spark from small battery.
You turn the Switch, Engine does the rest.
Regan Vapor Stationary Engines, 1 to 12 H. P.
Regan Vapor Pumping Engines, 350 to 10,000 gallons capacity.

—MANUFACTURED BY—
THOMAS KANE & CO.,
CHICAGO, ILL.
Send stamp for catalogue "V."

BUILDERS OF HIGH GRADE BOATS.



Speed 20 miles an hour.

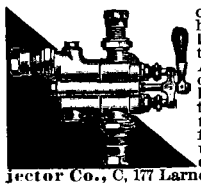
We Build Everything, from a Canoe to a Steam Yacht.
Complete Stock Oars, Sweeps and Boat Trimmings.
We Make all Sizes Pipe Boilers and Engines.
Cedar Row Boats from $25 upward.
Vapor and Steam Launches from $300 upward.
SEND 10c. FOR COMPLETE CATALOGUE.
DAVIS BOAT AND OAR CO., DETROIT, MICH., U. S. A.

VAN DUZEN'S Steam JET PUMP

PUMPS ANY KIND OF LIQUID.
Does not clog, freeze or get out of order. Always ready. All brass. **Every Pump Guaranteed.** 10 sizes. **Capacity 100 to 10,000 gallons per hour.** Prices **$7** and upwards. For full information write to
The VAN DUZEN & TIFT CO.
(PUMP DEPARTMENT)
CINCINNATI, O.

SMOKELESS GUNPOWDER.—AN INteresting article by Hudson Maxim on the manufacture and use of smokeless gunpowder, giving a sketch of its history and the methods of producing it. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 821. Price 10 cents. To be had at this office and from all newsdealers.

World Injectors



operated entirely by a single handle and therefore the **simplest** to operate. Single turn of the handle is all that is required. Always to be depended upon and consequently the **safest and best.** If you use, or are likely to use **Boiler Feeders, Ejectors, Jet Pumps, etc.,** send for Catalogue. It contains valuable information and tables for engineers, etc. **American Injector Co.,** C, 177 Larned St., Detroit, Mich.

TANNING BY THE AID OF ELECtricity.—By Dr. S. Rideal and A. P. Trotter. An elaborate review of the subject of tanning by means of electricity, giving the results of the researches into its history and practicability. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 814. Price 10 cents. To be had at this office and from all newsdealers.

"Improvement the order of the age."
THE SMITH PREMIER TYPEWRITER

Important Improvements.
All the Essential Features greatly perfected.
The Most Durable in Alignment.
Easiest Running and Most Silent.
All type cleaned in 10 seconds without soiling the hands.
The Smith Premier Typewriter Co., Syracuse, N. Y., U. S. A.
Send for Catalogue.

SEND FOR CIRCULAR. **WINANS ANTI INCRUSTATION POWDER OR BOILER COMPOUND** FOR REMOVING SCALE IN BOILERS.
WILL SAVE ITS COST IN FUEL AND REPAIRING
PEERLESS PISTON AND VALVE ROD PACKING.
MAGNOLIA ANTI FRICTION METAL.
ST MARY'S ELECTRIC DAMPER REGULATOR
J. C. WINANS 220 FREMONT ST. SAN FRANCISCO, CAL.
MANHATTAN PACKING

LOOK! LOOK!
Unusual chance for young men in every State in Union and Canada to establish a business of their own. A **monopoly, just out and patented. Exclusive State rights.** The Hess Postal Box—furnishing **Envelopes, Stamps, Paper** and **Postal Cards** by **Nickel in Slot.** Write at once. **Don't delay.** A small fortune and permanent business.
The Hess Postal Facility & Supply Co.,
123 S. 7th St., Philadelphia, Pa.

EDISON
GENERAL ELECTRIC CO.
INCANDESCENT AND ARC LIGHT PLANTS.
Stationary and Railway Motors.—Lamps.—Cables.—Safety Devices.

DISTRICT OFFICES.

Canadian.....Edison Building, 77 Bay St., Toronto, Can.	Pacific Coast..Edison B'lding, 112 Bush St., S. Fran., Cal.
Central.....173 & 175 Adams St., Chicago, Ill.	Pacific Northwest...Fleischner Building, Portland, Ore.
Eastern.....Edison Building, Broad St., New York.	Rocky Mountain. . ....Masonic Building, Denver, Colo.
New England.....25 Otis St., Boston, Mass.	

Mexican and South American Department.....Edison Building, Broad Street, New York.
European Office .....34 Victoria Street, Westminster, London, S.W., England.

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

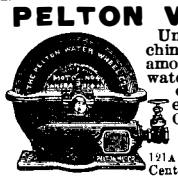
ARTESIAN
Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 1,000 feet. Write us stating exactly what is required and send for illustrated catalogue. Address
PIERCE ARTESIAN & OIL WELL SUPPLY CO.,
80 BEAVER STREET, NEW YORK.

YOU HAVE SOMETHING
to live for if you have not seen our new

CENTURY COLUMBIA,
with Pneumatic Tires. Light, Strong, Durable, and fully guaranteed.
POPE MFG. CO., 221 Columbus Ave., Boston.
12 Warren St., N. Y. 291 Wabash Ave., Chicago.
Factory, Hartford, Conn.

Chucks **The NATIONAL.**
INDEPENDENT. UNIVERSAL. COMBINATION.
Strongest. Easiest to change. Best Finish. **Reversible Jaws** (patented) giving 5 changes including every possible desired position.
NEW CATALOGUE, illustrated, sent free. Liberal discounts. Prompt shipment. Address
The Nat'l Chuck Mfg. Co., Mt. Vernon, N. Y.

PELTON WATER MOTOR.



Unequaled for all light running machinery. Warranted to develop a given amount of power with one-half the water required by any other. Evidence of unquestioned superiority afforded on application. Send for Circular. Address,
The Pelton Water Wheel Co.,
191A Main Street, San Francisco, Cal., or 235B Central Building, Liberty & West Sts., N. Y.

KODAKS
are always loaded ready for immediate use. They can be used for roll films or glass plates. The new
Daylight Kodak
can be loaded in daylight. Registers exposures and locks automatically when a new film is turned into place.
$8.50 to $25.00
THE EASTMAN COMPANY,
Send for Circulars. ROCHESTER, N. Y.

PATENT JACKET KETTLES

Plain or Porcelain Lined.
Tested to 100 lb. pressure. Send for Lists.
BARROWS-SAVERY CO.,
S. Front & Reed Streets, Philadelphia, Pa.

SYLPH CYCLES RUN EASY

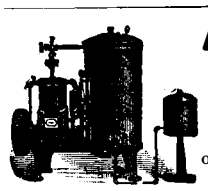
Hollow Tires.

Perfection of cycle manufacture; no need now to ride springless cycles or depend on tires alone for comfort. *Sylph Spring Frame* destroys vibrat'n. Light, simple, strong. Cata. free. *Rouse-Duryea Cy. Co.*
16 G St., Peoria, Ill. AGTS. WANTED

THE GIBBS PATENT DUST PROTECTOR.
For protecting the nose and mouth from inhalations of dust of every character. Invaluable in mills and factories. **Perfect** protection with **perfect** ventilation. Dust inhaled into the nose and lungs results in Catarrh and Consumption. Nickel plated protector sent postpaid on receipt of $1.
Gibbs Respirator Co.,
36 S. La Salle St., Chicago.

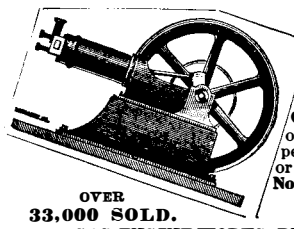
FOOT POWER LATHES

For Electrical and Experimental Work.
For Gunsmiths & Tool Makers. For General Machine Shop Work.
High Grade Tools; elegant in design, superior in construction. The best foot power lathes made, and quality considered, the cheapest. *Send for catalogue and prices.*
W. F. & JOHN BARNES CO., 1999 Ruby St., Rockford, Ill.



After being on the Market Five Years
The "ACME" Still Leads!
Sizes One, Two, Three, and Four Horse Power. Arranged for either NATURAL GAS or Kerosene Oil fire, as ordered. No extra insurance required on account of the oil fire.
Send for catalogue giving full particulars and prices.
Acme Automatic Safety Engine.—Stationary. Oil Tank.
ROCHESTER MACHINE TOOL WORKS. Brown's Race, ROCHESTER, N. Y.

THE GRAVES ELEVATORS.
PASSENGER & FREIGHT
L. S. GRAVES & SON ROCHESTER N.Y. NEW YORK. BOSTON. ST LOUIS. DETROIT.



"OTTO"
GAS AND GASOLINE **ENGINES,**
1-3 to 100 horsepower
Can be used in cities or in country independent of gas works or gas machines.
No Boiler.
No Danger.
No Engineer.
OVER **33,000 SOLD.**
OTTO GAS ENGINE WORKS, PHILADELPHIA.

BALL AUTOMATIC CUT OFF ENGINE
MADE ONLY BY **THE BALL ENGINE CO.**
ERIE PA.

THE

SCIENTIFIC AMERICAN

ESTABLISHED 1846.

The Most Popular Scientific Paper in the World

Only $3.00 a Year, Including Postage.
Weekly—52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 361 Broadway, New York.

THE

Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,

MUNN & CO., 361 Broadway, New York,
Publishers SCIENTIFIC AMERICAN.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern architectural construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,
361 Broadway, New York.

GEAR CUTTING
Leland, Faulconer & Norton Co., Detroit, Mich

PRINTING INKS
The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

© 1892 SCIENTIFIC AMERICAN, INC.